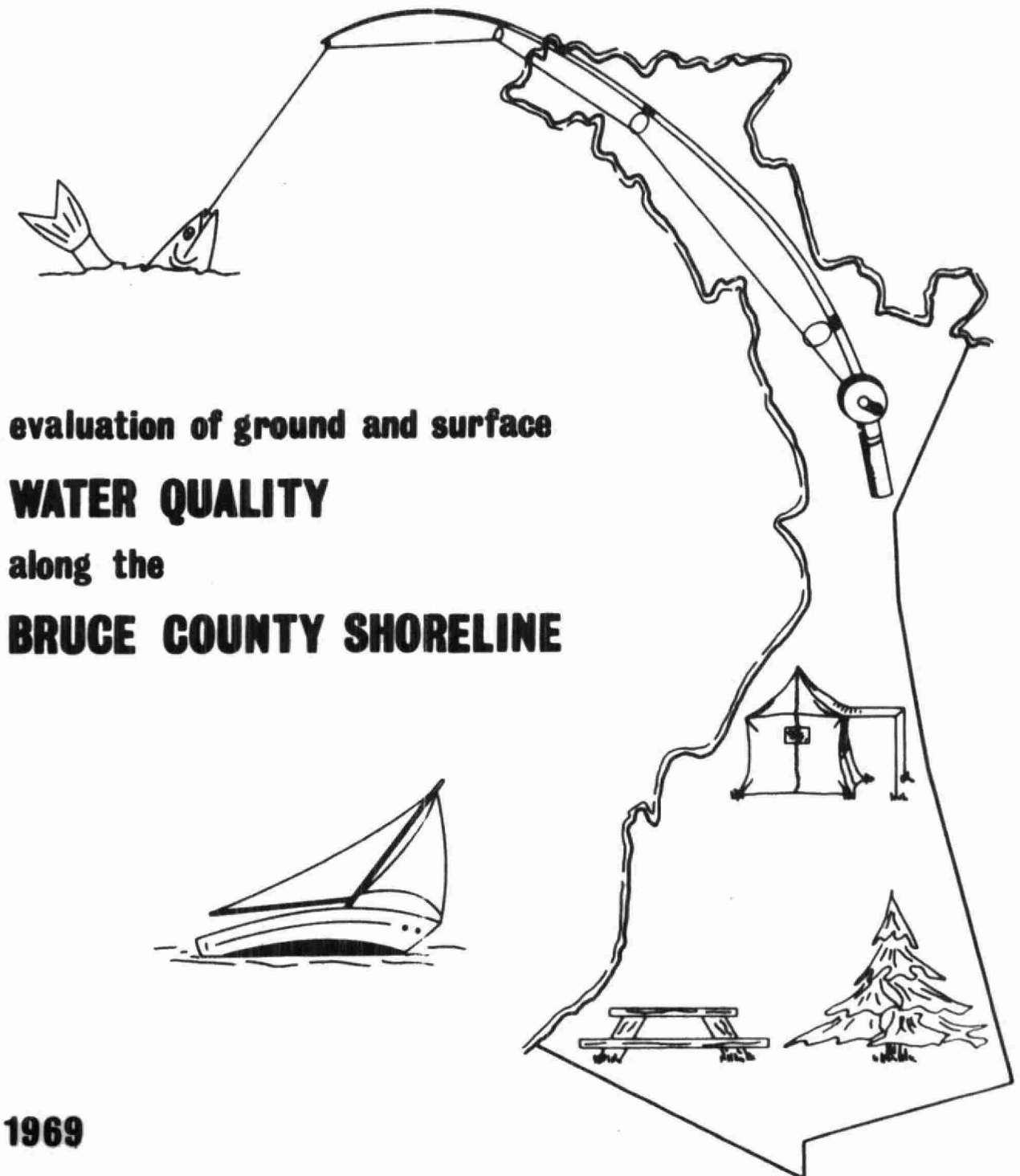




evaluation of ground and surface
WATER QUALITY
along the
BRUCE COUNTY SHORELINE

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on the

EVALUATION OF GROUND AND SURFACE

WATER QUALITY

along the

BRUCE COUNTY SHORELINE

Ontario Water Resources Commission

Division of Sanitary Engineering

District Engineers Branch

1969

GENERAL TABLE OF CONTENTS

	<u>PAGE</u>
ACKNOWLEDGEMENTS	i
LIST OF FIGURES	ii
LIST OF TABLES	iii
CHAPTER 1 - GENERAL INTRODUCTION	1
CHAPTER 2 - SCOPE AND INTENT	8
CHAPTER 3 - SUMMARY AND RECOMMENDATIONS	11
CHAPTER 4 - TOWNSHIP OF ALBEMARLE	39
CHAPTER 5 - TOWNSHIP OF AMABEL	50
CHAPTER 6 - TOWNSHIP OF BRUCE	63
CHAPTER 7 - TOWNSHIP OF EASTNOR	76
CHAPTER 8 - TOWNSHIP OF HURON	88
CHAPTER 9 - TOWNSHIP OF KINCARDINE	98
CHAPTER 10 - TOWNSHIP OF LINDSAY	110
CHAPTER 11 - TOWNSHIP OF SAUGEEN	120
CHAPTER 12 - TOWNSHIP OF ST. EDMUNDS	132
CHAPTER 13 - GENERAL DISCUSSION	143
Appendix 1 - Pollution Survey of Sauble Beach	160
Appendix 2 - Pollution Survey of Lions Head	180
Appendix 3 - Pollution Survey of Tobermory	196

	<u>PAGE</u>
Appendix 4-21 - Analytical Results	211
Appendix 22 - Suggested Construction Techniques	285
Appendix 23 - Terms and Symbols	292
Bibliography	301

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The laboratory work carried out in conjunction with the sampling surveys was performed by the Public Health Laboratories in Palmerston and the Ontario Water Resources Commission's Division of Laboratories in Toronto.

LIST OF FIGURES

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
1	Bruce County - Soil Materials	13
2	Bruce County - Population Distribution	14
3	Bruce County - Geological Cross-Section	Pocket
4	Bruce County - Drainage Pattern	16
5	Bruce County - Shoreline Water Supplies	18
6	North Sauble Beach - Ponding Area	24
7	Sauble Beach - Indian Beach	24
8	Sauble Beach - Main St. Storm Sewer	28
9	North Sauble Beach - Summer Population	28
10	Township of Albemarle - Sampling Locations	42
11	Township of Albemarle - Shoreline Water Supplies	43
12	Township of Albemarle - Chemical Quality	45
13	Township of Amabel - Sampling Locations	54
14	Township of Amabel - Shoreline Water Supplies	53
15	Township of Amabel - Chemical Quality	56
16	Township of Bruce - Sampling Locations	68
17	Township of Bruce - Shoreline Water Supplies	69

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
18	Township of Bruce - Chemical Quality	70
19	Township of Eastnor - Sampling Locations	79
20	Township of Eastnor - Shoreline Water Supplies	81
21	Township of Eastnor - Chemical Quality	82
22	Township of Huron - Sampling Locations	91
23	Township of Huron - Shoreline Water Supplies	92
24	Township of Huron - Chemical Quality	94
25	Township of Kincardine - Sampling Locations	103
26	Township of Kincardine - Shoreline Water Supplies	104
27	Township of Kincardine - Chemical Quality	105
28	Township of Lindsay - Sampling Locations	113
29	Township of Lindsay - Shoreline Water Supplies	114
30	Township of Lindsay - Chemical Quality	116
31	Township of Saugeen - Sampling Locations	124
32	Township of Saugeen - Shoreline Water Supplies	125
33	Township of Saugeen - Chemical Quality	127
34	Township of St. Edmunds - Sampling Locations	135

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
35	Township of St. Edmunds - Chemical Quality	136
36	Township of St. Edmunds - Shoreline Water Supplies	137
37	Bruce County - Drilled Wells	149
38	Bruce County - Dug Wells	150
39	Bruce County - Sandpoints	151
40	Bruce County - Lake Huron Supplies	154
<u>APPENDIX 1</u>		
1	Sauble Beach South - Sampling Locations	178
2	Sauble Beach North - Sampling Locations	179
<u>APPENDIX 2</u>		
1	Lions Head - Scott St. Storm Sewer	186
2	Lions Head - Webster St. Storm Sewer	186
3	Lions Head - Sampling Locations	189
<u>APPENDIX 3</u>		
1	Tobermory Bay - Sampling Locations	202
<u>APPENDIX 22</u>		
	Suggested Construction Techniques	285
1	Dug Well	286
2	Bored Well	287
3	Drilled Well	288
4	Sandpoint	289

<u>FIGURE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
5	Spring Supply	290
6	Septic Tank Systems	291

LIST OF TABLES

<u>TABLE NO.</u>	<u>TITLE</u>	<u>PAGE</u>
1	Bruce County - Bedrock Formation	4
2	Bruce County - Bacteriological Analyses of Drilled Wells	17
3	Bruce County - Communal Water Supplies	19
4	Summary of Water Supplies and Quality	25
5	Township of Albemarle - Communal Systems	44
6	Township of Bruce - Communal Systems	67
7	Township of Huron - Communal Systems	93
8	Township of Kincardine - Communal Systems	102
9	Township of Saugeen - Fairway Park W.W.	125
10	Porosity of Natural Sediments	145
11	River Flow Data	153

CHAPTER 1

GENERAL INTRODUCTION

	<u>PAGE</u>
1. LOCATION	2
2. HISTORY	2
3. TOPOGRAPHY	3
4. DRAINAGE	4
5. CLIMATE	5
6. LAND USE	6
7. POPULATION	6
8. ECONOMY	7

GENERAL INTRODUCTION

1. Location

The County of Bruce is located in south-western Ontario, bordered on the south by the County of Huron, on the east by the County of Grey and the waters of Georgian Bay, and on the north and west by Lake Huron. Bruce County embodies 31 geographical municipalities of which 12 border on the Lake Huron shoreline. These 12, 2 towns, 1 village and 9 townships are the principal concern of this report.

2. History

Prior to 1836, the County of Bruce was the occupied territory of the Ojibway Indians. By way of a treaty signed in 1836, the Indians relinquished all lands with the exception of the Bruce Peninsula, parts of which are still Indian property. The present-day towns of Kincardine and Southampton emerged from the wilderness with the arrival of the first settlers in 1848. By 1881 most of the southern portion of the County was settled with northern settlement progressing favourably. The primary concern of the early settler was the clearing and seeding of the new land and by 1881 most of the farms were used for mixed husbandry. The original township surveys were carried out during the period of years between 1851 and 1861. The major settlements

were incorporated as villages in the period from 1858 to 1880 and as towns from 1875 to 1949.

3. Topography

Bruce County incorporates a total land area of 1,056,000 acres or 1,650 square miles. Of this total acreage, 75.2 per cent or 793,741 acres are occupied farm land.

The overburden of the County varies noticeably with location. The northern section, notably the Bruce Peninsula, exhibits an overburden of the Breypen series and as such is composed of bare bedrock with small pockets of muck or soil scattered throughout. Rock outcrops are a frequent occurrence in this region but due to the depth of soil cover in southern areas of the County, they become rather infrequent. The southern regions of the County possess a much more variable overburden. For the most part, southern soils are sandy or gravelly depending upon location although lacustrine clays are found in an area between the Town of Chesley and the lakeshore.

Narrow belts of limestone formations trending nearly north and south prevail in Bruce County. Seven different bedrock formations exist in the County distinguished by their colour and crystalline nature as noted below:

TABLE I

BEDROCK FORMATIONS	
FORMATION	CHARACTERISTICS
QUEENSTON	BRICK-RED, ARGILLACEOUS AND SANDY SHALE
MEDINA	GREY TO BLUE-GREY, SEMI-CRYSTALLINE DOLOMITE
LOCKPORT	BUFF OR BROWNISH-GREY GRANULAR DOLOMITE
GUELPH	FINE-GRAINED, CRYSTALLINE DOLOMITE
SALINA	FINE-GRAINED DENSE BROWN DOLOMITE; DOLOMITIC GREY SHALE
BERTIE-AKRON	FINELY CRYSTALLINE DENSE DOLOMITE AND DOLOMITIC LIMESTONE
NORFOLK	FINE-GRAINED LIMESTONE; MAGNESIUM LIMESTONE AND DOLOMITE (GREY TO BROWN)

Average altitudes in Bruce County range from 600 to 1,025 feet above mean sea level, the highest point in the County being in the Walkerton district. The lay of the land tends to slope towards the west with the result that major drainage patterns flow in this direction.

4. Drainage

Bruce County is drained by four major rivers and a number of smaller rivers and streams. The westerly-directed flow carries all surface drainage to Lake Huron. The Pine and Penetangore rivers, emptying into Lake Huron south of the Town of Kincardine and at Kincardine respectively, drain the southern portion of the County. The central regions of the County are drained by the Saugeen and

Sauble rivers which enter the Lake at Southampton and North Sauble Beach respectively. The northern sections of the County (Bruce Peninsula) are drained by a large number of smaller rivers and streams.

5. Climate

With reference to climatic conditions, the County is divided into two separate climatic zones. Those areas bordering on the Lake Huron shoreline, including the entire Bruce Peninsula, enjoy a moderate climate due, in part, to the modifying effect of the lake and Georgian Bay. The second zone comprising all other areas of the County is affected by the moderating effect of the lake and consequently, is subject to more severe climatic conditions.

The Meteorological Division of the Canada Department of Transport has stations established at Lucknow, Walkerton, Southampton, Wiarton, and Tobermory. Data from these stations give a good indication of weather statistics within the County. Annual figures for rainfall range from 31 inches in the north to 35 inches in the south. Annual snowfall figures vary with location, usually falling in the range from 80 to 120 inches. Winter temperatures along the shorelines average roughly 23°F with lower temperatures recorded inland. Mean annual temperatures for Bruce County usually are 43 to 44°F.

6. Land Use

The majority of Bruce County, roughly 75.2 per cent, is occupied farm land. Agricultural endeavours in the County consist mainly of livestock raising and mixed farming. The Peninsula, being mainly bare bedrock, is of little value for agricultural use. Generally this area is best suited for forests, although certain parts have been cleared and are producing fair grain crops. Being chiefly a vacation land, cottage development has grown very rapidly in the past few years.

7. Population

Since 1931 there has been a general decrease in the population of Bruce County. As of the 1968 census, the County population stood at 41,307 permanent residents. Fluctuations of this figure result from the influx of tourists during the summer months at which time 25-40 per cent increases in population are recorded. Population densities vary greatly within the County but the figure of 25 persons per square mile is a reasonable average. The Peninsula has a population density range of 1 to 21 persons per square mile whereas southern townships, e.g. Kincardine, have densities ranging from 22 to 70 persons per square mile.

8. Economy

The economic landscape of this area consists of low intensity agricultural utilization and intermediate intensity forest utilization. Little in the way of industrialization or business and commerce is found in Bruce County. The prime manufacturing concern is the furniture and wood products industry, having its centres in the four major towns of Kincardine, Wiarton, Port Elgin and Southampton. During the years 1951-1961 industrial employment in the area decreased.

By far the most important industry in Bruce County is the tourist trade and its related businesses. The Sauble Beach recreational area located in the Township of Amabel is perhaps the best known resort region in the County. This area with its long expanse of white sandy beaches experiences population peaks of over 13,000 per cent of the permanent resident population. The waters of Lake Huron and Georgian Bay contribute to the seasonal water sports of boating, swimming, skin diving, water skiing, etc. for thousands of people every year.

CHAPTER 2

SCOPE AND INTENT

SCOPE AND INTENT

The pollution report on the County of Bruce is based on survey field work conducted in the County during the summer of 1969. The field work consisted of a sanitary survey as well as a pollution survey conducted in those townships bordering on Lake Huron, Georgian Bay, or waters thereof. In addition to the nine townships surveyed, the three population centres of Lion's Head, Tobermory, and Sauble Beach were investigated in detail. The major towns along the shoreline were not investigated.

The report attempts to seek out areas of pollution within the County assessing them as either present or future problem areas. In order to evaluate the cause and extent of pollution along the Lake Huron shoreline in the County of Bruce, it is necessary to outline the current status of waste disposal systems and drinking water supplies. In this regard, the efficiency and adequacy of municipal and private water supply and pollution control facilities are reviewed in order to indicate where improvements are required. Where such facilities are not available, conditions are examined to indicate areas in which water or sewage works should be provided. Surface and ground water are discussed with respect to quality, quantity, development and uses, to determine measures necessary to ensure their protection and proper development.

The ultimate objective and primary intent of this report is to make recommendations concerning general policies to be followed in the field of pollution control and water supply in the County of Bruce.

CHAPTER 3

SUMMARY AND RECOMMENDATIONS

	<u>PAGE</u>
I SUMMARY	
1. General	12
2. Water Supplies	15
3. Wastewater Disposal Practices	21
4. Immediate Problem Areas	22
5. Long Term Problem Areas	27
II RECOMMENDATIONS	
Township of Albemarle	30
Township of Amabel	30
Township of Bruce	31
Township of Eastnor	33
Township of Huron	33
Township of Kincardine	34
Township of Lindsay	35
Township of Saugeen	36
Township of St. Edmunds	37
Village of Lions Head	38

I SUMMARY

1. General

The Bruce County shoreline exceeds 200 miles in length and embodies 14 geographical municipalities composed of nine townships, four towns and one village. The entire peninsula and parts of Amabel Township are predominantly of the Breypen series which consists of bare bedrock supporting small pockets of soil or muck scattered throughout. This is indicated in Fig. 1 which presents the major soil areas. The bedrock is composed mainly of sedimentary rocks (limestones and related calcareous rocks, shales, sandstones and conglomerates). The limestones predominate at various locations and although they are dense and impervious, they are the most soluble of all rocks and, where they have been subjected to the leaching action of water containing dissolved carbon dioxide, they form numerous small solution passages and caverns. Underground streams are formed in the course of time and these usually overflow to create springs. Shales are generally impervious and sandstones are porous and consequently among the most productive aquifers. The water-bearing capacity of the conglomerates are quite varied.

The normal population concentration of the county is shown in Fig. 2, page 14 and an estimate of the summer peaks is also presented.

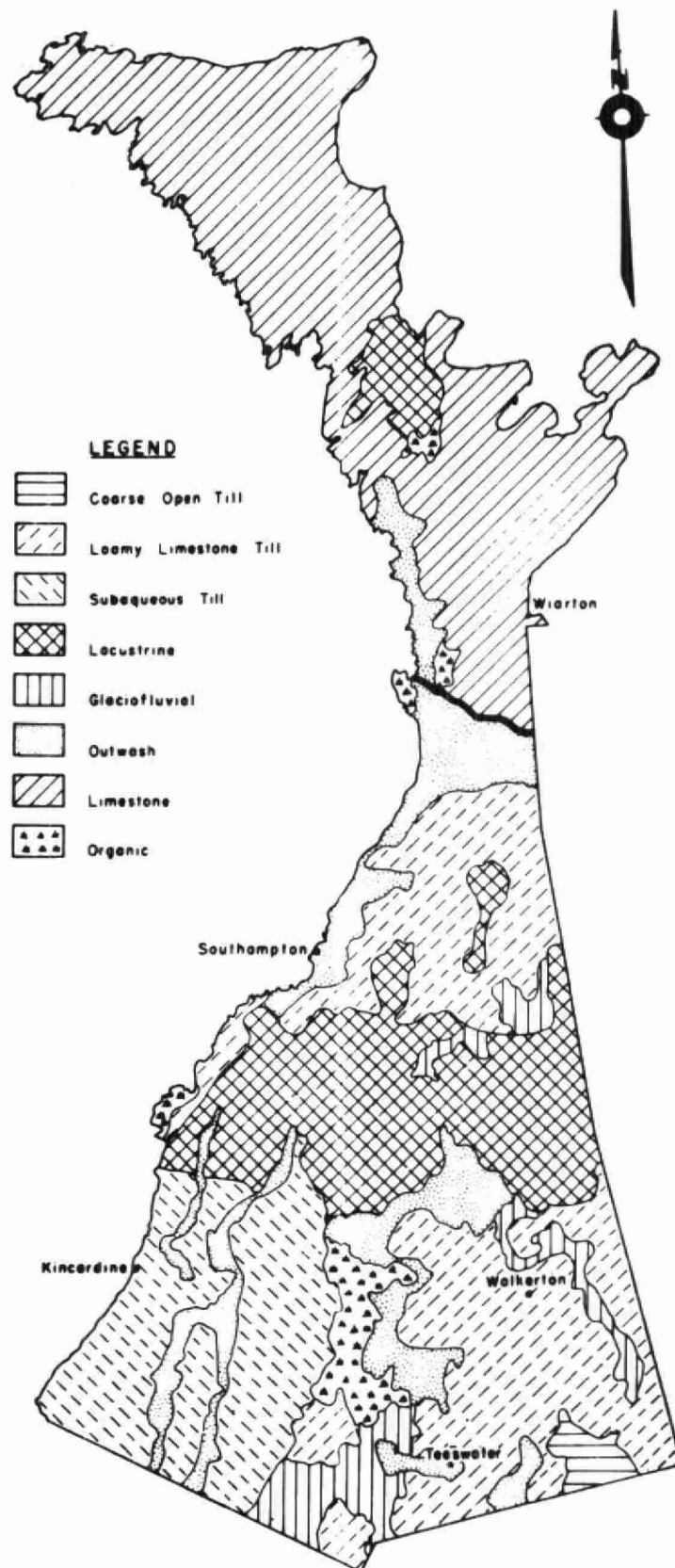


FIG. 1 BRUCE COUNTY DISTRIBUTION OF SOIL MATERIALS

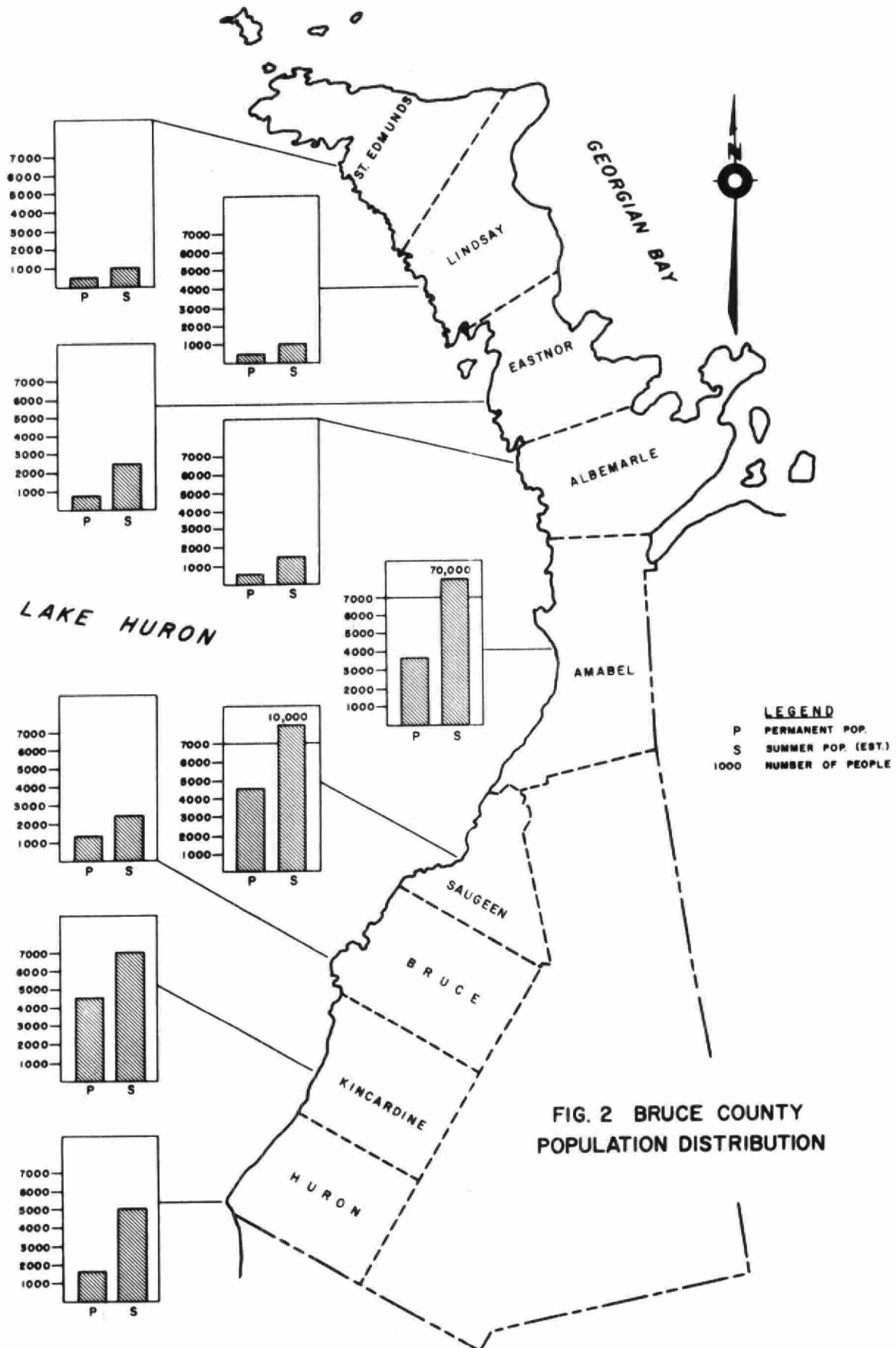


FIG. 2 BRUCE COUNTY
POPULATION DISTRIBUTION

2. Water Supplies

Good aquifers are sometimes encountered in limestone at depths in excess of a mile; however, most groundwater developments are usually less than 2,000 feet deep. The average depth of the drilled wells sampled during this survey was less than 100 feet.

The formation of underground streams is quite noticeable since springs are abundant along the western shore of the peninsula. The appended geological cross-section (in map pocket) presents the hydraulic gradients for the peninsula and these indicate flow to be in a westerly direction. These streams originate in the eastern portion of the peninsula and follow the slope of the bedrock towards the west side. (The direction of flow is further indicated by the direction of flow of the surface drainage pattern as depicted in Figure 4 on page 16). Streams are first polluted near their source along the east shore where they receive surface water, via cracks, solution passages, etc. as they move towards the western shoreline. The bacteriological analyses indicate this phenomenon as shown in Table 2 below, which summarizes the total number of drilled wells sampled along both shorelines and indicates that the groundwater pollution in St. Edmunds and Eastnor townships is greater on the west shore.

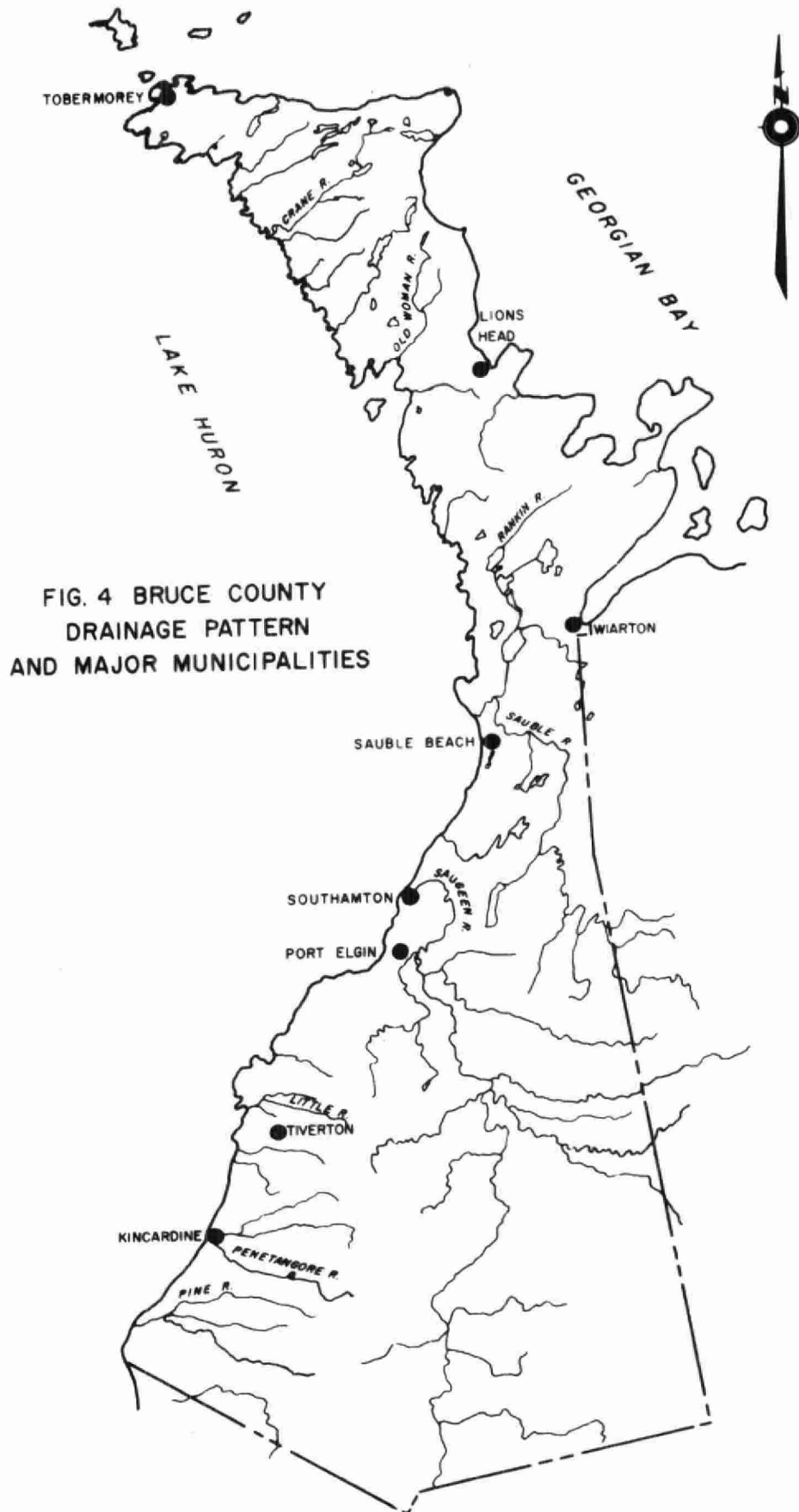


TABLE 2

BACTERIOLOGICAL ANALYSES OF DRILLED WELLS

<u>TOWNSHIP</u>	<u>NO. SAMPLED</u>	<u>NO. ADVERSE</u>	<u>% ADVERSE</u>
ST. EDMUNDS EAST	2	0	0
ST. EDMUNDS WEST	7	3	43
LINDSAY WEST	6	5	83
EASTNOR EAST	9	5	56
EASTNOR WEST	31	21	68
AMABEL WEST	23	11	48
ALBEMARLE EAST	1	1	100
ALBEMARLE WEST	9	1	11
SAUGEEN WEST	6	0	0
BRUCE WEST	14	2	14
KINCARDINE WEST	13	1	8
HURON WEST	26	2	8

The general problem area associated with the bacteriological pollution of the groundwater can therefore be taken on a geographical basis, depending upon soil type, rather than township divisions. Figure 4 shows the general soil conditions of the county shoreline and a division line from the Chief's Point Indian Reserve to Hepworth could be used to indicate the transition line north of which the ground water quality is relatively poor and south of which it is relatively good. The same dividing line may also be used to indicate areas suitable for disposal of wastewater by individual septic tank systems. The northern area is unsuitable for septic tank disposal systems and even the utilization of constructed elevated disposal beds is undesirable in this situation, since the tank effluent quickly percolates through this strata, intersects the bedrock and runs off to enter the ground and/or surface water streams. In the southern portion, gravel and

sand are naturally present and this makes the area conducive to septic tank disposal systems.

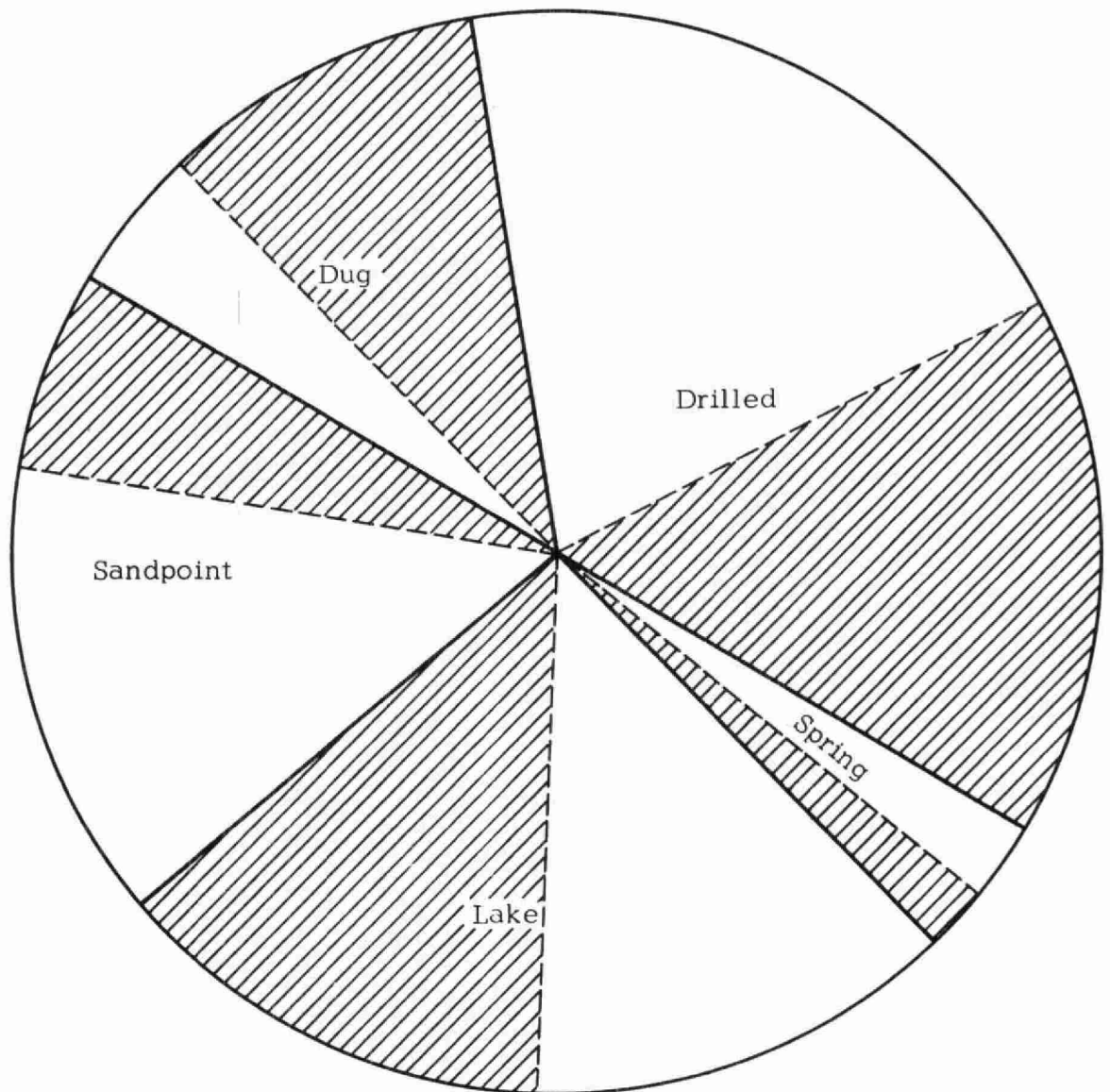


FIGURE 5 - BRUCE COUNTY
- shoreline water supplies -
///percent adverse

The drinking water sources in Bruce County were sampled using a systematic procedure to obtain a meaningful concentration figure of the various supplies. Figure 5 summarizes the most common drinking water

supplies used in the county and the per cent of the adverse samples are also indicated here to isolate the areas of greatest concern. It should be pointed out that the areas of greatest concern are those which are not serviced by communal water treatment and distribution systems. The northern shoreline of the peninsula is serviced by only five such systems, while the southern shoreline, which represents only approximately 30% of the entire area, is serviced by 41. (1) Only 12 per cent of the southern water supplies indicated the presence of adverse water samples while 33 per cent of the northern samples contained coliform bacteria. The following table summarizes the communal systems on a township basis.

TABLE 3

<u>COMMUNAL WATER SUPPLIES</u>				
<u>TOWNSHIP</u>	<u>NO. OF SYSTEMS</u>	<u>NO. INSPECTED</u>	<u>NO. OF SAMPLES</u>	
			<u>TAKEN</u>	<u>ADVERSE</u>
<u>NORTHERN AREA</u>				
ALBEMARLE	2	2	3	0
AMABEL	1	1	3	2
EASTNOR	0	0	0	0
LINDSAY	0	0	0	0
ST. EDMUNDS	0	0	0	0
<u>SOUTHERN AREA</u>				
BRUCE	3	3	6	1
HURON	32	30	41	3
KINCARDINE	5	4	7	1
SAUGEEN	1	1	4	0

(1) These figures do not include municipal or OWRC systems.

By comparing these figures to those of the survey, it is evident that the utilization of communal systems has unquestionable advantages in controlling the domestic drinking water quality. Some of the adverse sample results were due to improper operation on behalf of the owner, however, this problem will soon be improved since it is now usually a condition of draft approval for all new subdivisions that the associated water supply be deeded to the municipality after construction.

In conjunction with the land survey, a boat survey of the waters bordering the county was also carried out and the results indicated that the lake water is generally of a superior quality, both chemically and bacteriologically than the groundwater. The latter was found to contain high concentrations of phenols, iron, sulphur and coliform bacteria in many cases. The source of the phenols was not determined but because of the great extent of their concentrations, it is probably related to the presence of natural gases and oils in the sedimentary rocks of the area.

In summary, any future water supplies in the northern area should be constructed on a communal basis using lake water as the preferred supply. Because the construction of a system of this type is expensive in a rocky terrain, areas of development should be established in favour of the present spotted development to reduce the cost per connection. This system would allow proper quality

control and have unquestionable advantages in treating the domestic wastes produced.

3. Wastewater Disposal Practices

A major factor influencing the health of individuals where public sewers are not available is the proper disposal of human excreta. Many diseases, such as dysentery, infectious hepatitis, typhoid and paratyphoid, and various types of diarrhea are transmitted from one person to another through the fecal contamination of food and water, largely due to the improper disposal of human wastes. For this reason, every effort should be made to prevent such hazards and to dispose of all human waste so that no opportunity will exist for contamination of water or food.

Limestone formations are not desirable for the disposal of wastewater and the acquirement of drinking water because channelling could easily develop which would result in the wastewater being directly fed into the drinking water aquifer without allowing for adequate natural treatment. The treatment of over 90 per cent of the wastewater in the county is carried out by septic tank and tile field systems although pit privies, cesspools and other miscellaneous methods are also used. Because of the condition of the dug and drilled wells in the northern areas, it is evident that these methods

are actually failing in their purpose. In many cases, the disposal fields associated with the septic tank systems are of fill construction above the bare bedrock. This often results in erosion and subsequent runoff of partially treated sewage along the surface of the bedrock until it flows into a fissure. Direct pollution of the groundwater is consequently achieved.

The only ultimate solution to problems of this nature is one similar to that of obtaining potable drinking water, namely the construction of communal collector systems with associated treatment facilities. Since this type of a system is again expensive, development areas should be established to prohibit building in all unsuitable areas. Areas classified as unsuitable should generally include the northern portion and particularly sites which require the construction of a disposal field prior to the installation of the treatment facility. The enforcement of such a program is the only ultimate solution in clearing up pollution of the Bruce Peninsula. Steps in this direction should be taken without hesitation or the county water quality will deteriorate rapidly and a serious health hazard could result.

4. Immediate Problem Areas

The immediate problem areas associated with the shoreline counties along with a summary of the domestic water sources and

qualities are presented in Table 4. Tobermory, Lions Head, Sauble Beach and Inverhuron present water pollution problems which should be corrected immediately to avert any possible outbreak of health hazards.

Sauble Beach and Inverhuron are overcrowded during the summer months and this is evident by the presence of septic tank effluent ponding along the beach areas involved. The disposal systems associated with these cottages were probably designed as one family dwellings for seasonal occupancy. Because these units are used by the owner's family and friends during the entire summer season (and at many locations on an annual basis), it is not uncommon to find the majority of the cottages very overcrowded. This situation leads to the overtaxing of the small disposal facility which causes the soil to become saturated and consequently, the sewage ponds on the surface. Many of these ponds were observed along Sauble Beach during the survey and some of them are depicted in Figures 6 and 7. Figure 6 shows the extreme health hazards associated with this situation because most children will tend to play in these areas and could easily contact one of the many diseases associated with the wastewater. Strict measures must be taken to control development here and repairs should be carried out on the existing facilities.

Figure 8 shows the Main Street storm sewer as it enters the

TABLE 4 - SUMMARY

TOWNSHIP	POPULATION		SOIL TYPE AND DESCRIPTION	WATER SUPPLIES		QUALITY		PROBLEMS
	PERMANENT	EST. SUMMER PEAKS		SOURCES	% OF TOTAL SUPPLIES	BACT	CHEM	
ST. EDMUNDS	467	1,000	BREYPEN SERIES -ROCK OUTCROPS -LIMESTONE FORMATION	A) DRILLED WELL B) DUG WELL C) LAKE	30 1 69	POOR POOR GOOD	PHENOLS	THE TOBERMORY HARBOUR IS RECEIVING POLLUTANTS FROM PLEASURE CRAFTS & HOMES IN THE SURROUNDING AREA. AREA UNDESIRABLE FOR SEPTIC TANK SYSTEMS.
LINDSEY	302	1,000	BREYPEN SERIES	A) DRILLED WELL B) DUG WELL C) LAKE	55 -- 45	POOR POOR GOOD		AREA UNDESIRABLE FOR INDIVIDUAL DISPOSAL OF WASTES AND COLLECTION OF WATER.
EASTNOR	840	2,500	BREYPEN SERIES	A) DRILLED WELL B) DUG WELLS C) LAKE D) SPRINGS	51 6 37 6	POOR POOR GOOD		LIONS HEAD REQUIRES COMMUNAL SEWAGE COLLECTOR SYSTEM AND TREATMENT WORKS.
ALBEMARLE	583	1,500	BREYPEN SERIES	A) DRILLED WELL B) DUG WELL C) LAKE D) SPRINGS	27 27 40 6	GOOD POOR GOOD POOR		WEST SHORELINE BEGINNING TO DEVELOP - AREA NOT SUITABLE FOR INDIVIDUAL SEWAGE DISPOSAL SYSTEMS.
AMABEL	3867	70,000	EASTPORT SERIES -DUNE SAND & SANDY LOAM	A) SANDPOINTS B) DRILLED WELL C) LAKE D) DUG WELL E) SPRINGS	40 30 15 10 5	GOOD GOOD POOR POOR GOOD		COTTAGE DEVELOPMENT ALONG SAUBLE BEACH IS EXCESSIVE. SEPTIC TANKS ARE OVERLOADED AND MALFUNCTIONING.

TABLE 4 - SUMMARY (CONTINUED)

<u>TOWNSHIP</u>	<u>POPULATION</u>		<u>SOIL TYPE AND DESCRIPTION</u>	<u>WATER SUPPLIES</u>		<u>QUALITY</u>		<u>PROBLEMS</u>
	<u>PERMANENT</u>	<u>EST. SUMMER PEAKS</u>		<u>SOURCES</u>	<u>% OF TOTAL SUPPLIES</u>	<u>BACT</u>	<u>CHEM</u>	
SAUGEEN	4696	10,000	PLOMFIELD & BRADY SERIES -WELL SORTED OUTWASH	A) SANDPOINT	70	GOOD	SULPHUR	SHORELINE IS BEGINNING TO BECOME OVERCROWDED AND PROBLEMS MAY RESULT IN OPERATION OF SEWAGE FACILITIES.
				B) DRILLED WELL	15	GOOD	IRON	
				C) DUG WELL	10	POOR		
				D) SPRINGS	5	POOR		
BRUCE	1131	2,500	ELDERSLIE SERIES -LOCUS BRINE CLAY AND WELL SORTED OUTWASH	A) DRILLED WELL	45	GOOD		NO IMMEDIATE PROBLEM.
				B) DUG WELL	30	POOR	SULPHUR & IRON	
				C) SANDPOINT	15	GOOD	SULPHUR	
				D) SPRING	10	GOOD		
KINCARDINE	4612	7,000	PERTH & SULLIVAN SERIES -GOOD DRAINAGE -WELL SORTED OUTWASH -SANDY LOAM	A) DRILLED WELL	80	GOOD		COTTAGE DEVELOPMENT IS HEAVY AND SEWAGE TREATMENT FACILITIES ARE BEING OVERLOADED.
				B) DUG WELL	10	POOR		
				C) LAKE	10	POOR		
HURON	1776	5,000	SULLIVAN & BROOKSTONE SERIES -GOOD DRAINAGE -PARTLY CLAY	A) DRILLED WELL AND (ARTESIAN WELL)	85	GOOD		NO IMMEDIATE PROBLEMS.
				B) DUG WELL	10	POOR		
				C) SPRINGS	5	POOR		

public beach area and Figure 9 depicts the normal population density during the summer months.

Lions Head and Tobermory possess problems in regard to mismanagement of the groundwater resources. The areas are unsuitable for individual water supplies and sewage disposal units and legislation is required to curb all future expansions at these sites without first taking steps to install communal water and sewage treatment facilities. The groundwater in the northern townships is polluted at most locations and preventative measures must be taken in this regard if the situation is to be rectified.

Pollution surveys of these three problem areas were carried out as part of the study and are presented in Appendix 1, 2 and 3. Figures 1 and 2 of the Lions Head survey, Appendix 2, are photographs depicting the pollution hazards on each end of the public beach area.

5. Long Term Problem Areas

The western shoreline of the entire peninsula is approaching a stage of rapid summer and permanent home development. To prevent further pollution of the lake and groundwater in the area, legislation is desperately required to curb spotted development along the shoreline. Areas of development should be defined and communal water and sewage treatment facilities must be constructed for the proper disposal of wastes and treatment of water. On rocky areas, the installation of septic tank

disposal systems should be discontinued and along the beach areas, these facilities must be oversized to include more than one family per dwelling at an annual basis.

Once this legislation is passed, it must be strictly enforced or the water supplies and beach areas in the peninsula will rapidly deteriorate.

II RECOMMENDATIONS

A summary of the recommendations is presented below:

TOWNSHIP OF ALBEMARLE

1. Future development in the township should be based on municipally-owned communal water distribution systems utilizing Lake Huron as a source in the east, and drilled wells or Lake Huron in the west.
2. The use of septic tank and tile field disposal systems can be continued in the township provided proper lot size, on which it is shown that these systems can be installed, and limited density of development is adhered to.
3. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.
4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

TOWNSHIP OF AMABEL

1. Existing and future development in the urban areas, i.e. Sauble Beach should be provided with communal water and

sewage treatment facilities. Treated Lake Huron water should be used as the source of water supply.

2. New development should be centered around those areas which are provided with services. The remaining sections should develop only if minimum population densities are permitted and individual well supplies and septic tank systems can be installed.
3. In areas where communal systems cannot be economically provided, i.e. Oliphant, development should be controlled to maintain minimum densities of population.
4. All existing water supply and sewage treatment facilities should be inspected and revamped where necessary to alleviate the existing pollution problems.
5. The present official plan should be studied to ensure, where possible, that proposed development patterns are in accordance with the findings of this report.

TOWNSHIP OF BRUCE

1. The Inverhuron Beach area should be provided with a communal drilled well water supply system and sewerage services. The municipality should, in an orderly fashion, assume the ownership of all existing private communal supplies.

2. New development should be centered around those areas which are provided with services. The remaining sections should develop only if minimum population densities are permitted and individual well supplies and septic tank systems can be installed.
3. With regard to the northern section, the existing water supplies and disposal systems should be inspected and revamped where necessary to reduce the pollution problems noted. If correction cannot be accomplished by this means, communal systems should be installed.
4. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.
5. In areas where services cannot be economically provided, development on individual services should be restricted to maintain minimum population density. Drilled wells are the preferred water supply source.
6. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

TOWNSHIP OF EASTNOR

1. The Barrow Bay and the Whippoorwill Bay shore areas should be provided with communal water and sewerage services. The water supply should be from Georgian Bay. The Pike Bay, Myles Bay, and Stokes Bay areas should be provided with communal water and the existing disposal systems inspected and revamped where necessary.
2. New development should be centered around those areas which are provided with services. The remaining sections should develop only if minimum population densities are permitted and individual well supplies and septic tank systems can be installed.
3. Filled lots should not be considered suitable for the installation of septic tank and tile field systems.
4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

TOWNSHIP OF HURON

1. The development of future subdivisions in the township should continue on the basis of communal deep well supplies and, where possible, existing and future sources should be integrated.

The municipality should, in an orderly fashion, assume the ownership of all existing private communal systems.

2. The use of septic tank and tile field disposal systems can be continued in the township provided proper lot size, on which it is shown that these systems can be installed, and limited density of development is adhered to.
3. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.
4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

TOWNSHIP OF KINCARDINE

1. All future development should proceed on the basis of communal well supplies and where possible integration of existing supplies should be carried out. The municipality should, in an orderly fashion, assume the ownership of all existing private communal supplies.
2. The use of septic tank and tile field systems, particularly in the Inverhuron area, should be reviewed and consideration

should be given to the installation of a communal sewerage system.

3. Except in the Inverhuron area, the use of septic tank and tile field disposal systems can be continued in the township provided proper lot size, on which it is shown that these systems can be installed and limited density of development is adhered to.
4. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.
5. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

TOWNSHIP OF LINDSAY

1. The Dyer Bay area should be provided with a municipally-owned communal surface water supply system.
2. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.
3. Future development on any scale should not be permitted in the

township except in areas where satisfactory wells and septic tank systems can be shown to be workable.

4. Filled lots should not be considered suitable for the installation of a septic tank and tile field disposal system.
5. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

TOWNSHIP OF SAUGEEN

1. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.
2. Any significant development in the township should be directed to those areas which can be reasonably serviced from the large urban area of Southampton and Port Elgin.
3. In the remaining sections, only large lots on which it is shown that individual wells and septic tank systems can be installed should be considered for development. Sandpoints as a water supply should be considered.
4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

TOWNSHIP OF ST. EDMUNDS

1. The Big Tub, Hopkins Bay, Warner Bay, and Dorcas Bay areas should be provided with communal surface water supply systems and the existing septic tanks and tile fields should be inspected and revamped where necessary.
2. No new development of any size should be permitted in the township. Only those lots which are large and on which wells and septic tank systems are shown to be workable should be considered for development. Filled lots should not be considered suitable for the installation of septic tank and tile field disposal.
3. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.
4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.
5. Communal water and sewage treatment facilities should be provided for the Community of Tobermory and treated Lake Huron water should be used as the source of supply.

VILLAGE OF LIONS HEAD

1. A communal sewerage system should be installed.
2. The existing combined sewers should be separated.

CHAPTER 4

TOWNSHIP OF ALBEMARLE

	<u>PAGE</u>
1. GENERAL	40
2. FIELD SURVEYS	41
3. WATER SUPPLY	43
4. WASTEWATER DISPOSAL	46
5. DISCUSSION	46
6. CONCLUSION	48
7. RECOMMENDATIONS	49

TOWNSHIP OF ALBEMARLE

1. GENERAL

The Township of Albemarle is located at the southern extremity of the Bruce Peninsula, bounded on the north by the Township of Eastnor, on the west by the waters of Lake Huron, on the south by the Township of Amabel, and on the east by the Cape Croker Indian Reserve and the waters of Georgian Bay (Colpoys Bay). The Township encompasses an area of 116.59 square miles of which roughly 69 per cent represents occupied farm land.

The western shoreline area of the township is composed of mainly bog affording very poor drainage in this area. Black well-decomposed organic material of varying depths lying over sand or clay is representative of the soil conditions in this region. The interior of the township as well as most of the eastern shoreline is predominantly bare bedrock (Breyden series) with pockets of soil of variable composition scattered throughout.

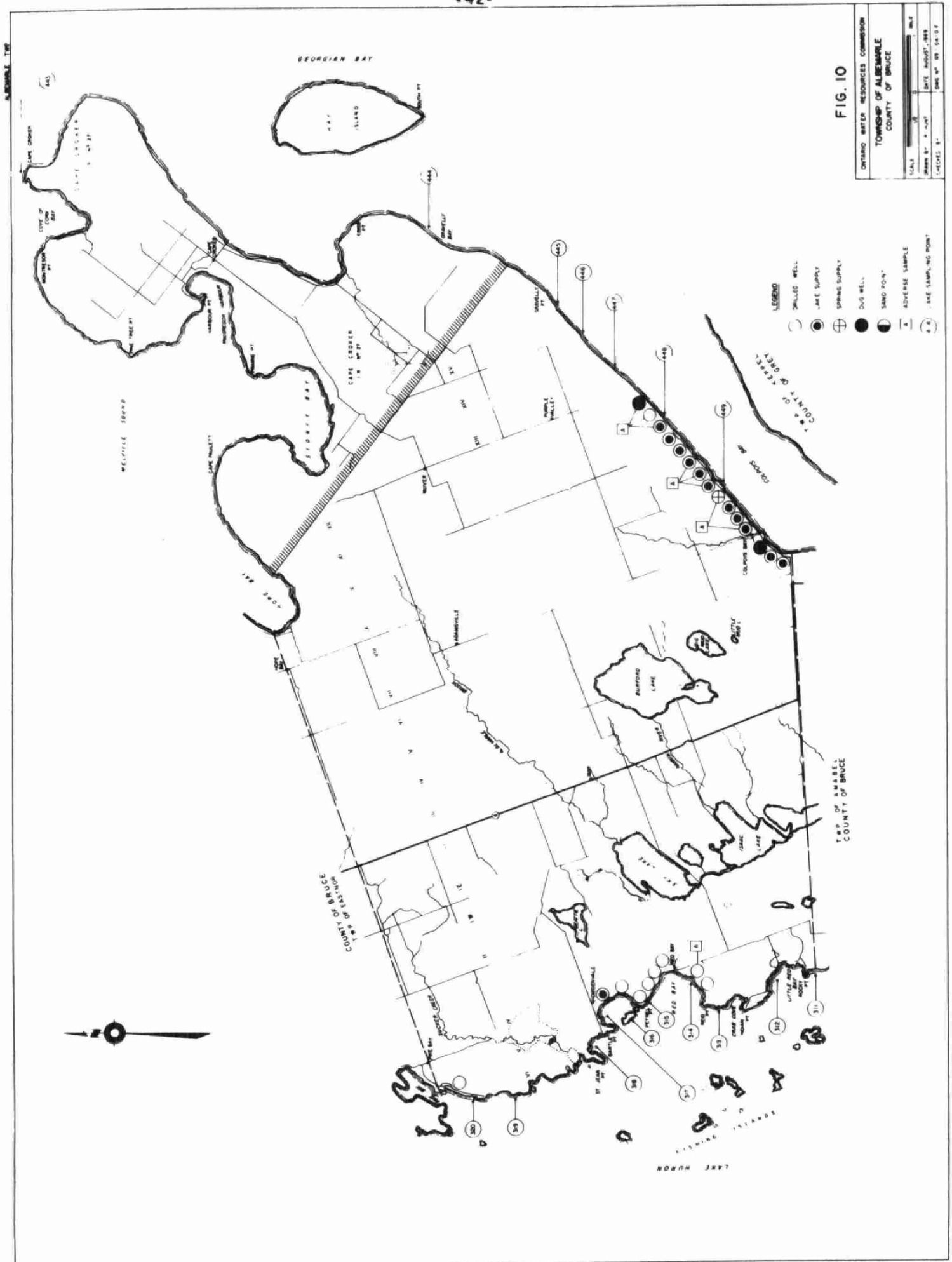
Population figures for the township as per the 1968 census show the permanent resident population to be 583. This population figure increases by several hundred per cent with the movement of the cottage owners and other tourists into the area during the summer months.

General mixed farming forms the basis of the township economy. The economic growth of the area has been greatly enhanced by the development of the tourist trade and its related retail businesses. Large cottage development has occurred along the western shoreline with major areas being Pike Bay, Red Bay, Howdenvale and Little Red Bay. The eastern shoreline has its prime development on Hope Bay and particularly along the shores of Colpoys Bay.

2. FIELD SURVEYS

The field work associated with this township survey was carried out during the period July 29 - 31, 1969 and consisted of a door-to-door sampling of private drinking water supplies. On the basis of results received from this sanitary survey, a letter was dispatched to all cottage owners in the township whose water supplies proved to be unsatisfactory. The letter advised that the suspect water should be boiled for a minimum of 10 minutes prior to human use.

A further survey was conducted on the lake on August 18-19, 1969. Lake samples were obtained at an average distance offshore of 300 feet from both the eastern and western shorelines during the survey. Figure 10 illustrates the approximate sampling locations of both surveys and indicates the areas of adverse water supplies.



3. WATER SUPPLY

Along the western shoreline roughly 90 per cent of the domestic water supplies are drilled wells ranging in depth from 24 to 125 feet. In this region, lake supplies make up only 5 per cent of the total with other supplies (mainly springs) comprising the remainder. Dug wells comprise 40 per cent of all water supplies on the eastern shores with an average depth of 15 feet. Lake supplies are the most abundant, forming 50 per cent of all the domestic supplies. Drilled wells and spring supplies make up the remainder. The various sources of the supplies examined for bacteriological content during the survey are presented in Appendix 4 and summarized in Figure 11. The number of

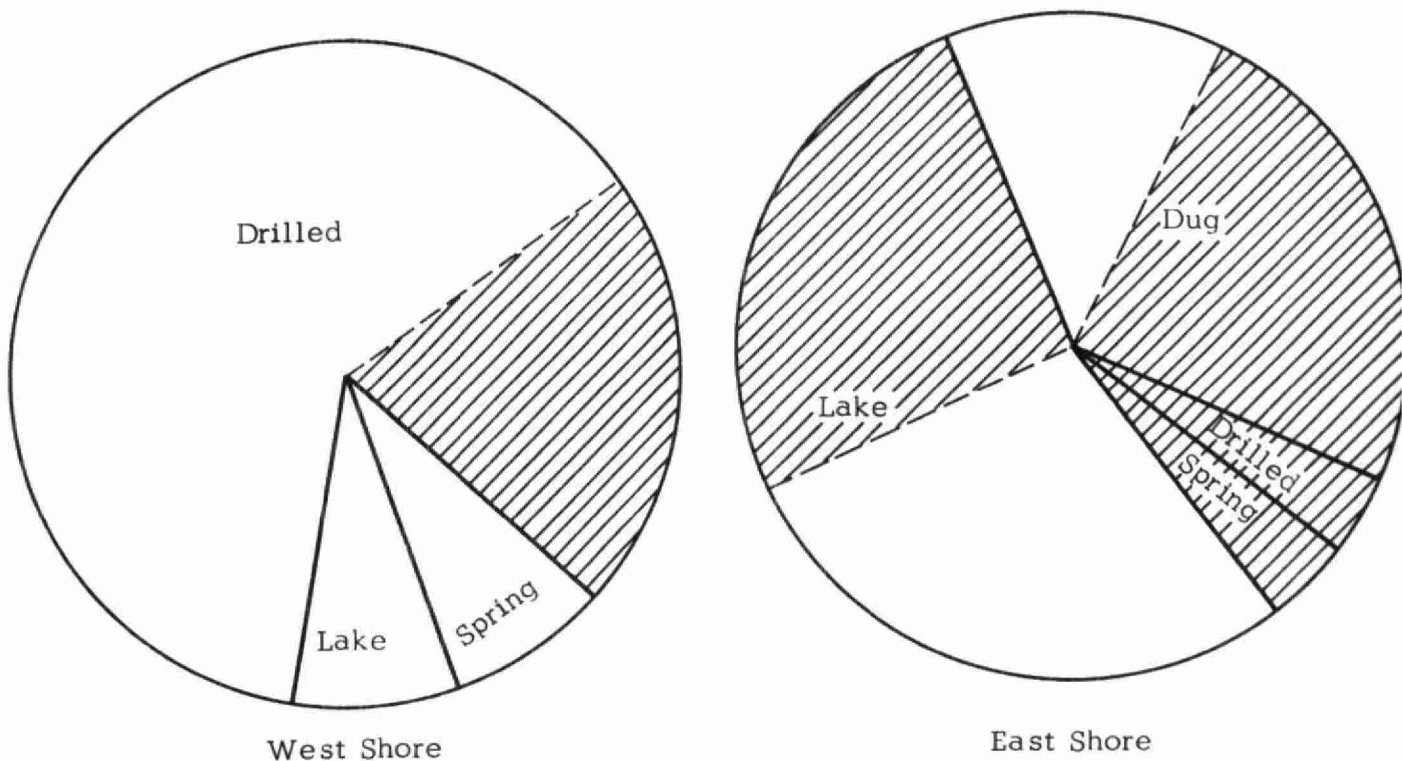


FIGURE 11: TOWNSHIP OF ALBEMARLE
- distribution of shoreline water supplies
/// indicate per cent adverse

bacteriologically adverse samples are superimposed on the different sources and indicate the percentage of adverse samples associated with each.

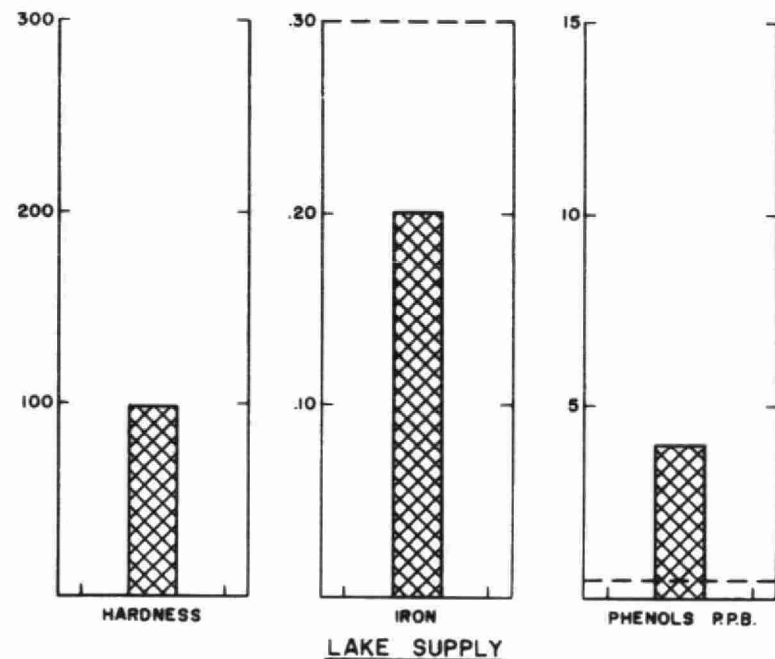
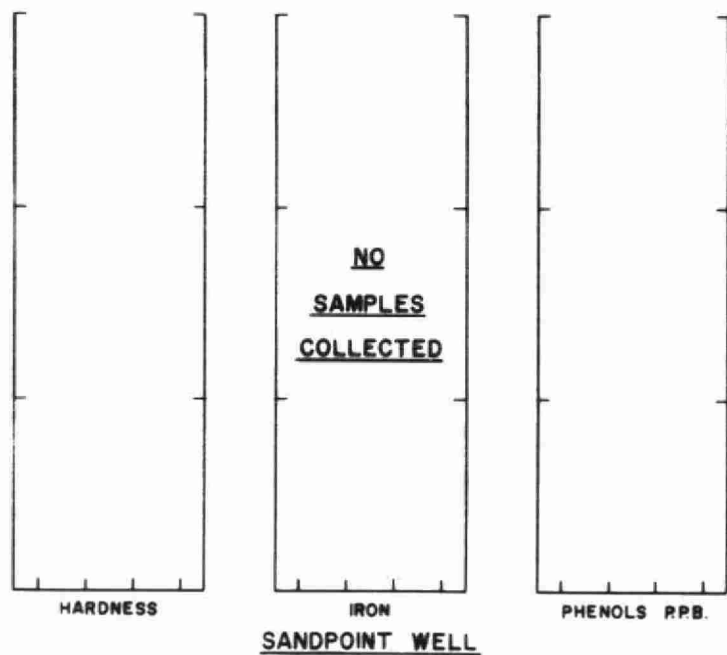
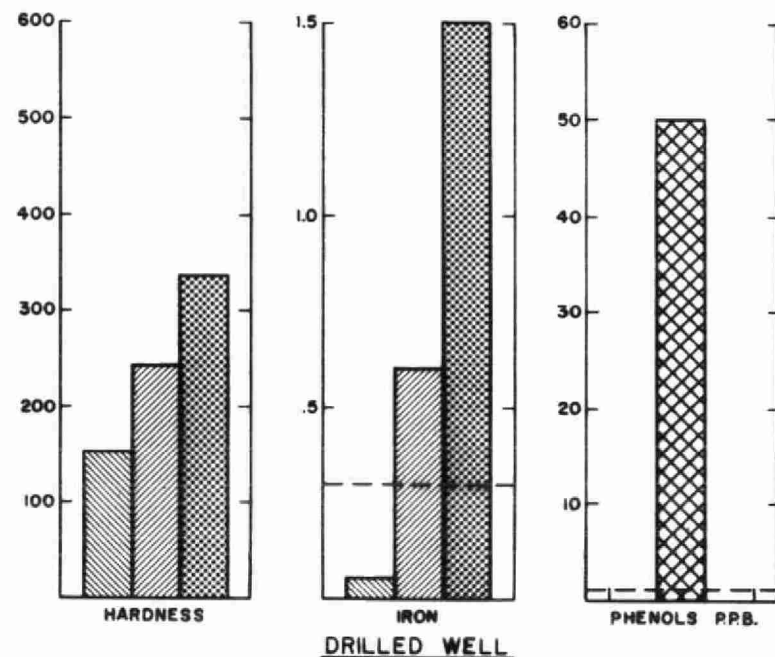
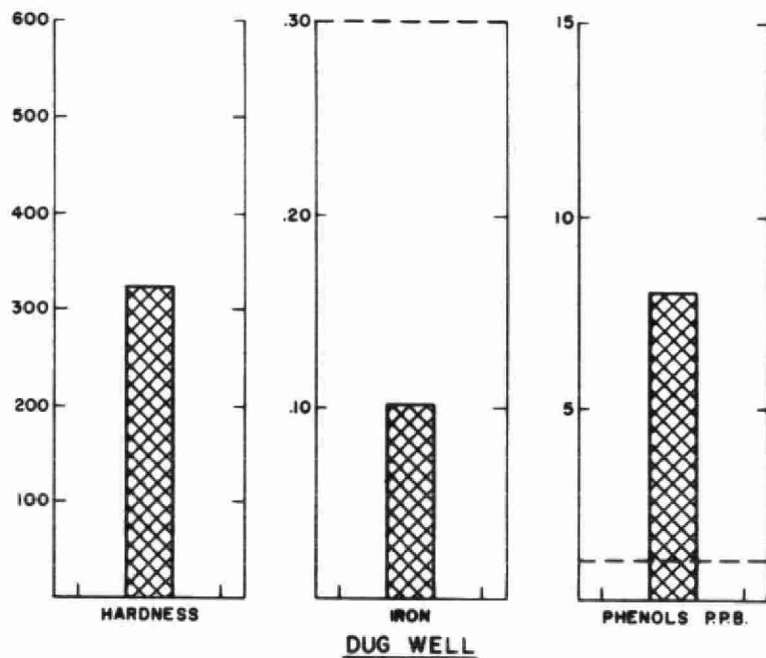
The chemical quality of the major water sources listed in Appendix 5 and summarized in Figure 12, indicate that excessive iron concentrations are associated with drilled wells. The phenol concentrations are excessive in all supplies.

At the present time, there are three known communal water supplies operating in the township. Two of these communal systems are utilizing well supplies and serving summer resorts located at Red Bay; the Evergreen Resort and the Wildwood Lodge. The third system is a spring water supply serving the Hamlet of Colpoys Bay. Table 5 summarizes these systems.

TABLE 5

COMMUNAL WATER SUPPLIES IN THE TOWNSHIP OF ALBEMARLE

	<u>COLPOYS BAY</u>	<u>EVERGREEN RESORT</u>	<u>WYLDWOOD LODGE</u>
OPERATOR	NO APPARENT OWNER	MR. A. BENNET RED BAY, ONTARIO	MR. F. THOMAS RED BAY, ONTARIO
SOURCE	SPRING	DRILLED WELL	2 DRILLED WELLS
SERVICES	16	41	36
CAPACITY	GRAVITY FLOW	670 G.P.H.	N.A.
TREATMENT	NONE	CHLORINATION SOFTENING	SOFTENING
WATER QUALITY	TREATMENT REQUIRED	SATISFACTORY	SATISFACTORY



----- OWRC RECOMMENDED LIMIT ----- IRON = .30, PHENOL = 1.0

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED



MINIMUM VALUE



AVERAGE VALUE



MAXIMUM VALUE



SINGLE SAMPLE

FIG. 12 ALBEMARLE TOWNSHIP

4. WASTEWATER DISPOSAL

At the present time, there are no sewers (storm or sanitary) and associated treatment works in operation within the township. Approximately 90 per cent of sewage disposal systems are septic tanks, the remainder composed of the pit privys. The high percentage of adverse samples obtained from drilled and dug wells in the township indicates that the area is experiencing wastewater disposal problems.

5. DISCUSSION

During the sanitary survey, a total of 37 drinking water samples were obtained of which 18 or 48.6 per cent were found to be adverse. The largest offenders amongst the different water supplies were the dug wells of which it was found that 70 per cent of the wells tested were unsafe for human use. The least affected supplies in this area would appear to be the drilled wells which exhibited 30 per cent adverse results. The lake supplies tested showed 50 per cent to be unsatisfactory as a safe drinking water supply.

The highest coliform counts found in samples taken during the sanitary survey were in the vicinity of 80 coliform organisms per 100 ml of sample. A drinking water supply is considered safe for

human consumption without treatment if the coliform bacteria count is 0 per 100 ml of sample. Faecal coliform counts as high as 80+ per 100 ml of sample were found in samples obtained during this survey. These organisms, when present in a drinking water supply, indicate that domestic sewage is entering the supply from some source.

The fact that the dug wells exhibit the poorest results can be attributed to the operation of these wells which relies on infiltration of the ground water. Improperly constructed or malfunctioning septic tank disposal systems would seem to be a likely source of the domestic wastes which are gaining access to the water supplies. Soil conditions in this township are not really suitable for this type of sewage disposal practice. The best soil for this type of disposal system is a sandy loam which acts as a good filter.

The drilled wells, although appearing to be the best sources, exhibited the highest coliform counts. When first drilled, the wells are usually capped. If this seal is improperly installed or is leaking, surface runoff waters may enter the well and pollute the water supply to some extent. In addition, the aquifer serving these wells may be on the receiving end for domestic pollutants from malfunctioning septic tanks.

The lake survey showed the lake water to be generally in satisfactory condition although some high coliform counts were obtained from several samples. Whether or not a surface supply is safe for human consumption, it should always be suspect and should be treated in some manner, usually boiling for a minimum of 10 minutes, before consumption.

A complete summary of all surveys within the township may be found in Appendix 4. The accompanying map (Figure 10) shows the location of sampling points and the specific supply sampled.

6. CONCLUSIONS

Cottage development along the western shoreline has grown considerably in the past few years. If allowed to continue unrestricted, pollution problems due to overcrowded conditions will appear. In order to prevent such problems, some means of subdivision control should be implemented within the township.

Soil conditions of the area are certainly not ideal for septic tank and tile field systems, however, if proper supervision is given to their construction, it is probable that these systems could operate efficiently with a minimum of problems.

The majority of the domestic water supplies in this township, especially along the eastern shoreline, were adverse during the survey.

Future water supplies should be taken from Lake Huron in the east and from springs, drilled wells, or Lake Huron in the west.

7. RECOMMENDATIONS

1. Future development in the township should be based on municipally-owned communal water distribution systems utilizing Lake Huron as a source in the east, and drilled wells or Lake Huron in the west.

2. The use of septic tank and tile field disposal systems can be continued in the township provided proper lot size, on which it is shown that these systems can be installed, and limited density of development is adhered to.

3. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary to alleviate the existing pollution problems.

4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 5

TOWNSHIP OF AMABEL

	<u>PAGE</u>
1. GENERAL	51
2. FIELD SURVEYS	52
3. WATER SUPPLY	53
4. WASTEWATER DISPOSAL	57
5. DISCUSSION	58
6. CONCLUSION	60
7. RECOMMENDATIONS	61

TOWNSHIP OF AMABEL

1. GENERAL

The Township of Amabel is located in the centre of Bruce County bounded on the north by the Township of Albemarle, on the east by Grey County, on the south by Saugeen Township, and on the west by the waters of Lake Huron. The Township embodies a total land area of 110.44 square miles of which approximately 79 per cent represents occupied farm land.

The western shoreline of this township is the location of the largest tourist attraction in the County of Bruce. Sauble Beach is a stretch of white sandy beach stretching over a distance of roughly 5 miles. The overburden of this area is a member of the Eastport series and as such consists of light grey dune sand which provides excessive natural drainage. The interior of the township exhibits an overburden of well-sorted outwash consisting of mainly sandy loam which provides natural drainage varying from good to excessive.

According to the 1968 census, the permanent resident population of this township was 1,562. This figure is rather insignificant when compared to population figures during the summer season. Peak population figures reach 70,000 persons in this area during the summer. The majority of this increase occurs in the area of Sauble Beach where

the summer population peaks at approximately 50,000 persons, the average summer population, usually in the neighborhood of 10,000.

The economic growth of the township has been based almost entirely on the tourist trade and its related retail services. No other place bears this out more than the Sauble Beach recreational area, the largest single tourist attraction in the county. A smaller portion of the local economy is based on the farming industry which is generally of the mixed variety.

2. FIELD SURVEYS

Private drinking water supplies were sampled during a sanitary survey conducted in the period from July 17 to August 7, 1969. This survey was conducted on a door-to-door basis of cottages along the western shoreline of the township. All types of water supply were visited and bacteriological analysis performed on these samples.

The lake water was sampled on several different occasions during the summer months. Surveys of this type are usually conducted at the beginning and end of the summer months in order that a better evaluation be made of the effect of the increased summer population. The first surveys were carried out on June 17 and 24, 1969. On July 2, August 12 and 26, 1969 similar re-surveys of the shoreline area were carried out. These samples were taken in roughly 2-3 feet of

water just offshore.

A separate lake survey was conducted by the Great Lakes Surveys Branch taking samples at an average of 400 feet offshore. This survey was carried out on August 12, 1969. A map of the township is presented as Figure 13 and shows the approximate location of the samples taken during both surveys. All bacteriological and chemical analyses are listed in Appendix 6 and 7 respectively.

3. WATER SUPPLY

Residences in the areas of the Township of Amabel which border Lake Huron are all served by privately owned water supply systems with the exception of the area about the Town of Wiarton which is served by a municipal water works. Figure 14 depicts the water supplies commonly used along the shoreline and indicates the percentage of each which showed the presence of coliform bacteria.

Sandpoint wells serve approximately 40 per cent of the residences and average in depth

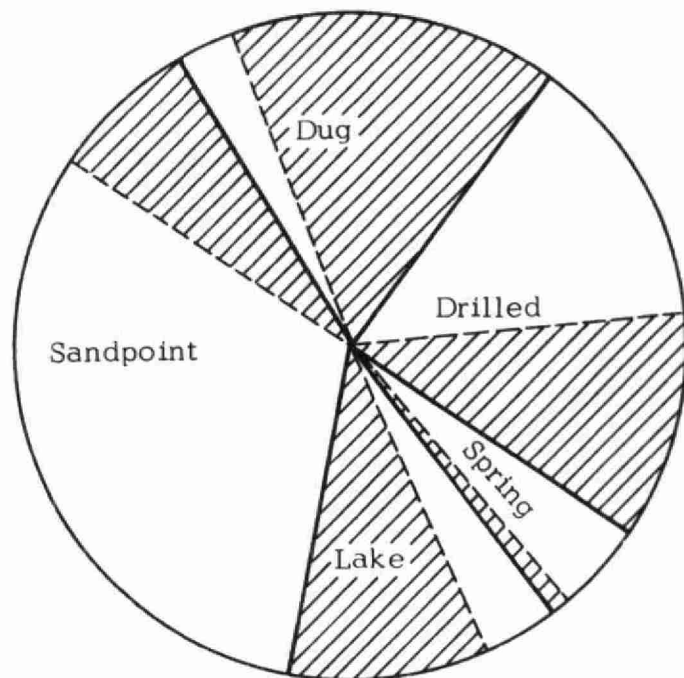
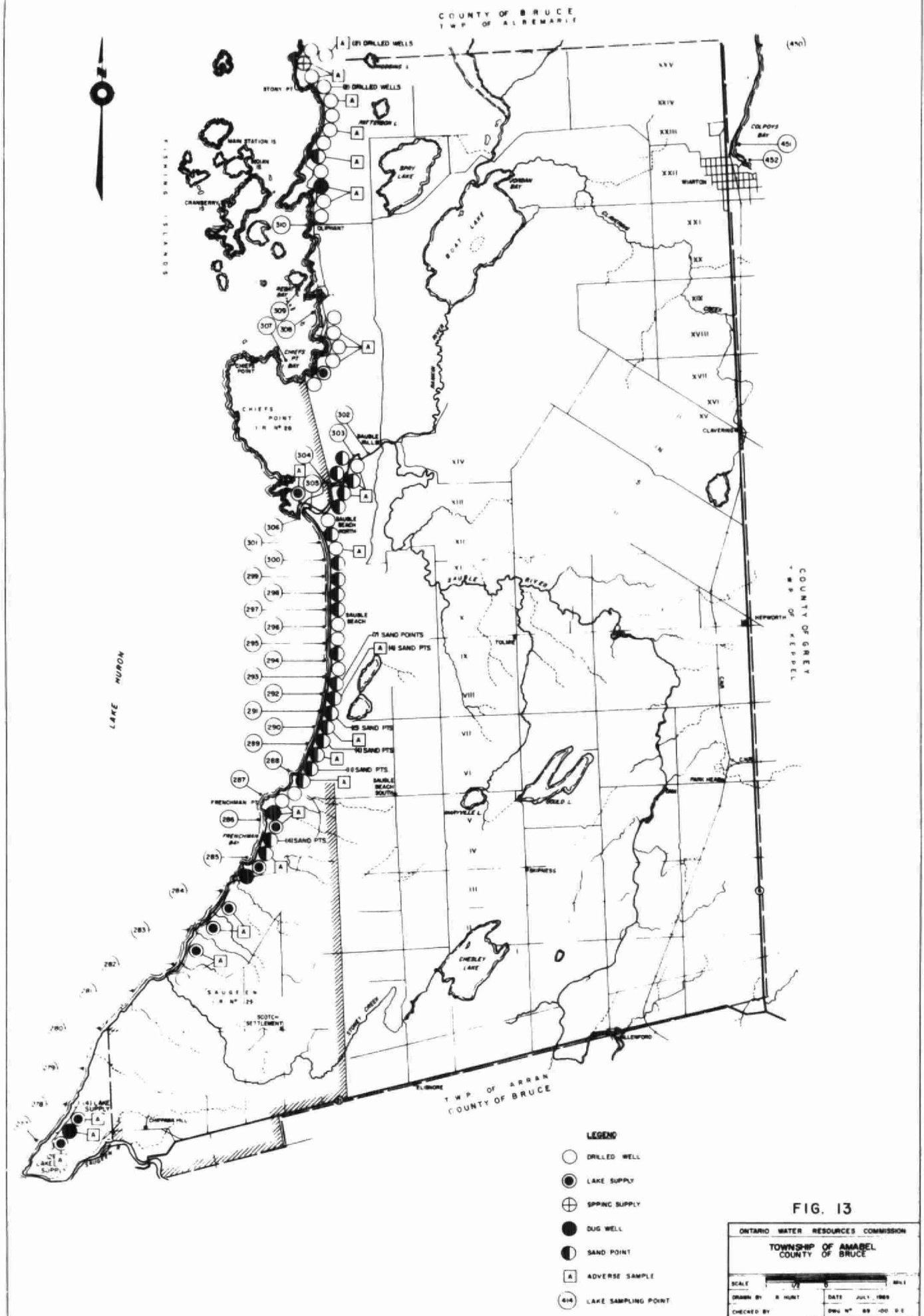


FIGURE 14 - AMABEL TOWNSHIP

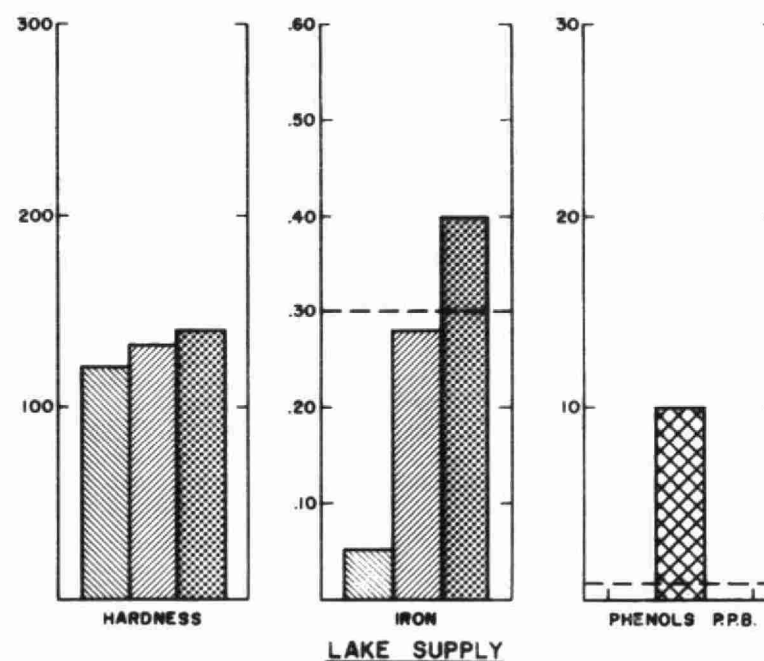
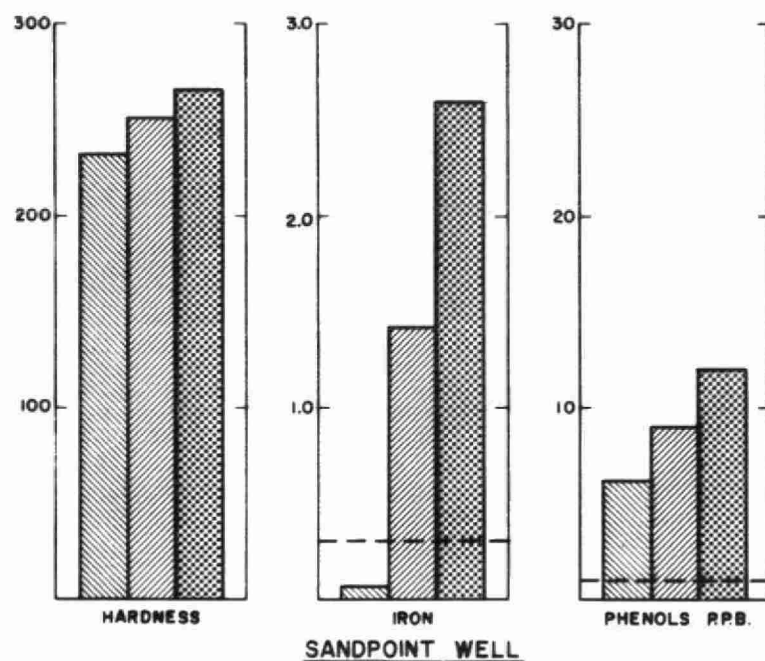
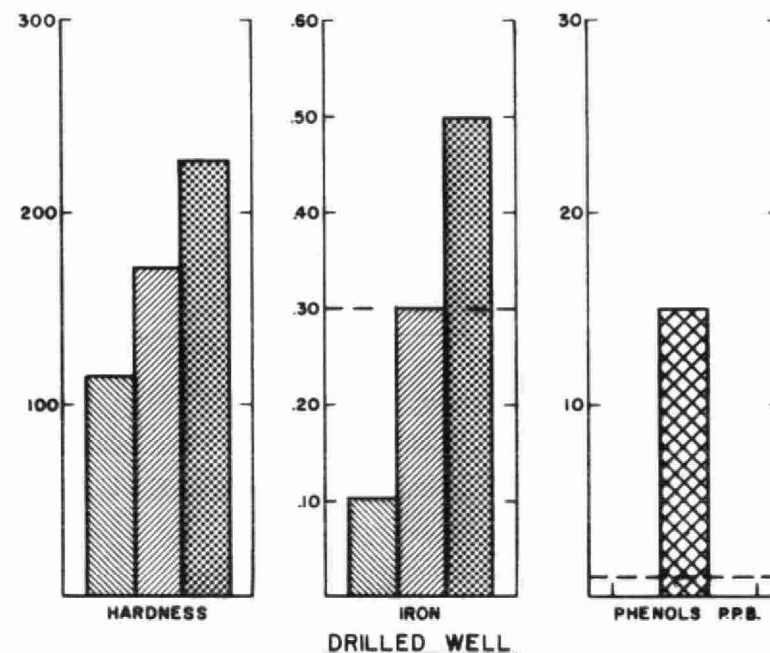
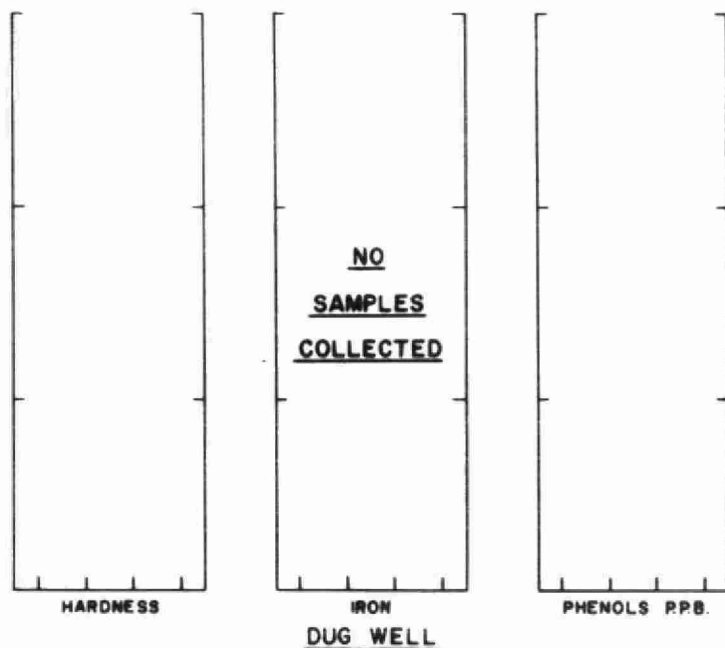
- distribution of water sources -
/// indicates per cent adverse
samples



from 6 to 20 feet. In the Sauble Beach area over 75 per cent of the cottagers obtain their water from sandpoints. Although no major problems have been associated with this general class of wells, they frequently lack the quantity of water demanded by the consumers. The major complaint registered concerning these wells is the high iron content resulting in the characteristic taste and yellowish-brown colour. Certain areas, notably North Sauble, report strong sulphur odour and taste. As lots in South Sauble are almost under water, the sandpoint water has a swampy odour in addition to the iron problem. Figure 15 summarizes the chemical quality of the various supplies and presents the OWRC objectives for each parameter.

The second main source of water is the drilled well. Approximately 30 per cent of the residences in Amabel Township are served by drilled wells that range in depth from 50 to 200 feet, averaging 70 feet. Although the initial construction of such a well is quite expensive, it provides an adequate quantity of water to meet most demands. In addition to the high iron content and hardness, the major complaint associated with the drilled wells is the obnoxious sulphur taste and odour.

Approximately 15 per cent of the residences are served by water works drawing water from Lake Huron. These systems are located mainly



----- OWRC RECOMMENDED LIMIT ----- IRON = .30, PHENOL = 1.0

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED



MINIMUM VALUE



AVERAGE VALUE



MAXIMUM VALUE



SINGLE SAMPLE

FIG. 15 AMABEL TOWNSHIP

in the area from Frenchman Bay to the Town of Southampton in the south and from Chief's Point north to the Township of Albemarle. The majority of these systems provide untreated lake water to the residences, however, because the lake water is bacteriologically unsafe for domestic consumption, several of these residents import their drinking water. A number of the lake supply water works are using "Sterasyl Filter Systems".

Dug wells serve roughly 10 per cent of the residences in this area. In general, the dug wells are improperly sealed and capped resulting in the majority of the supplies being found unsafe for consumer use.

4. WASTEWATER DISPOSAL

At the present time, with the exception of the Town of Wiarton, there are no municipal or community sewage works of any kind in the township.

In the Township of Amabel, over 90 per cent of the residences visited were served by septic tanks and tile beds of which approximately 50 per cent had separate connections for the sink and laundry systems. Due to the excellent suitability of the sandy soil in the Sauble Beach and Frenchman Bay areas, the septic tank and tile field systems meet the first condition for the proper operation of septic tank systems that

the soil must have an acceptable percolation rate. Of primary concern in this region is the fact that the lots are too small, thereby limiting the location of the septic tank and tile field and conflicting with the Department of Health septic tank location limits.

In the area from Chief's Point to the Township of Albemarle, the soil conditions change from the dry sands of Sauble Beach to a rocky overburden covered with pockets of sand thus creating unsuitable soil conditions for septic tank systems. Because of the unsuitable soil conditions in this area, over 50 per cent of the residences use sewage disposal systems other than septic tanks and tile beds. A large percentage use outdoor privys which are as bad or worse than the septic tank systems, due again to the rocky soil conditions.

5. DISCUSSION

During the sanitary survey, a total of 100 shoreline residences were visited and samples obtained from their drinking water. Of these samples, 37 per cent were found to be adverse by virtue of coliform organism counts, some as high as 100 per 100 ml. of sample. Of these adverse samples 43.3 per cent exhibited faecal coliform counts as high as 80+ per 100 ml of sample. The presence of faecal coliform in drinking water supplies pose a definite health hazard to the consumer. Letters to this effect were sent to all parties concerned warning of the adverse

results of samples taken from their drinking water. The letter advised that the suspect water be boiled for a minimum of 10 minutes prior to consumption.

Of the water supplies tested, the dug wells proved to be the most adverse supplies as 11 of the 13 sampled were found to be bacteriologically unsafe. Of those residences drawing water from the lake, most of which provide no prior treatment, it was found that 10 of the 13 sampled were unsatisfactory. Likewise, 11 of the 23 drilled wells tested were found to be bacteriologically unsafe. The systems which appear to be least affected by contamination are the sandpoints since only 8 of the 36 or 22.2 per cent were found to be adverse. The large majority of domestic water supplies in this region are sandpoints.

The fact that domestic wastes are gaining access to the private water supplies indicates that the most probable source is the septic tank and tile bed systems used in the area. The area surrounding the community of Oliphant is very rocky making it unsuitable for the construction and operation of septic tanks or pit privys. Domestic sewage escaping from these systems, which most likely are malfunctioning or were initially installed improperly, are polluting the water supplies in this particular area. The soil conditions of the Sauble Beach area are ideal for the proper functioning of a septic tank and tile bed. Unfortunately, the rapid development as a major resort has resulted in very

overcrowded conditions evidenced by the fact that 2-3 cottages have been built on the same lot. Added to this, the fact that each residence employs its own disposal system, has resulted in the soil becoming supersaturated with the wastes and eventually leading to ponding of these wastes on the surface. These ponds pose a definite threat to human health as many of the waterborne diseases can be communicated by transmission by flies or by direct contact. Diseases such as typhoid fever, dysentery, and other virus diseases including infectious hepatitis can be spread if this hazard is not avoided. Pictures of these areas were presented previously in Figures 6 to 9.

Results of the lake survey along the shoreline of the township showed that of the samples taken 67.6 per cent were found to be adverse. Of the samples taken 54.6 per cent showed the presence of faecal coliforms which indicate again that domestic wastes are entering the surface waters. These samples were taken at a distance of roughly 1,500 feet offshore, therefore, the results do not give a true indication of the lake water along the shoreline. Smaller surveys conducted just offshore show the severity of the pollution problem in Sauble Beach (refer to pollution survey on Sauble Beach in Appendix 1).

6. CONCLUSIONS

It would appear that the problem of pollution in the area of

Sauble Beach in particular and Amabel Township in general, is reaching major proportions. The extremely large development of the area as a tourist resort center is compounding this problem, necessitating immediate action if this resort area is to be preserved for future generations. The alarming rate of the rise of pollution in the area should force people to realize that proper and immediate action is mandatory.

It would seem, then, that the ultimate solution to the problem in Sauble Beach would be the establishment of a community sewer system and sewage treatment facilities.

7. RECOMMENDATIONS

1. Existing and future development in the urban areas; i.e. Sauble Beach, should be provided with communal water and sewage treatment facilities. Treated Lake Huron water should be used as the source of water supply.

2. New development should be centered around those areas which are provided with services. The remaining sections should develop only if minimum population densities are permitted and individual well supplies and septic tank systems can be installed.

3. In areas where communal systems cannot be economically provided; i.e. Oliphant, development should be controlled to maintain minimum densities of population.

4. All existing water supply and sewage treatment facilities should be inspected and revamped where necessary to alleviate the existing pollution problems.

5. The present official plan should be studied to ensure, where possible, that proposed development patterns are in accordance with the findings of this report.

CHAPTER 6

TOWNSHIP OF BRUCE

	<u>PAGE</u>
1. GENERAL	64
2. FIELD SURVEYS	66
3. WATER SUPPLY	66
4. WASTEWATER DISPOSAL	71
5. DISCUSSION	72
6. CONCLUSION	73
7. RECOMMENDATIONS	74

TOWNSHIP OF BRUCE

1. GENERAL

The Township of Bruce is located in the southern portion of Bruce County bordered on the north by the Township of Saugeen, on the east by the Township of Greenock, on the south by the Township of Kincardine and on the west by the waters of Lake Huron. A total land area of 110.07 square miles is encompassed by the township of which approximately 80 per cent represents occupied farm land.

As mentioned before, the overburden of the southern townships varies greatly with location. The immediate Bruce shoreline is the major concern of this report and therefore it will suffice to say that the interior of the township is mainly covered by Lacustrine clays of the Elderslie series. The shoreline areas are covered by well-sorted outwash which varies from a sandy to a gravelly variety. The vicinity of Douglas Pt. is predominated by the Plainfield series and as such consists of several layers of sandy material which exhibits excessive natural drainage because of the porosity of the materials. This soil is perhaps best used for recreational purposes. Further north, the surface cover changes to the Brisbane series, a member of the grey-brown Podzolic soil group. This series, characterized by several layers of gravelly loam and clay loam, exhibits imperfect natural drainage due, again, to the soil materials.

The northern portion of the shoreline is predominantly bog with the result that very poor natural drainage is characteristic of this region.

Population statistics based on the 1968 census record the permanent resident population as 1,131. However, this figure changes with the summer influx of tourists and cottagers into the region. The only centre of population density in the township is the Hamlet of Underwood which lists a population of approximately 200.

The local economy is based on agricultural land use (80 per cent of the township) as well as the tourist industry and its related retail services. The Ontario Hydro Electric Power Commission (HEPC) has an atomic power development at Douglas Pt. which commenced operation in late December 1966.

On January 7, 1965, a water pollution survey of the Township of Bruce was conducted by the Ontario Water Resources Commission. Such surveys are conducted routinely and upon request in an effort to locate and evaluate all sources of pollution, and to assess sewage treatment requirements throughout the province. The survey found no major sources of pollution in the township, although the existing refuse disposal site was found to be undesirable and a potential source of contamination of surface or ground waters. The report recommended the refuse disposal site be abandoned and a new site removed from any water-course be selected.

2. FIELD SURVEYS

The first survey carried out in the township was a sanitary survey conducted along the Lake Huron shoreline and consisting of a door-to-door sampling of private water supplies. In total, 33 water samples were obtained for bacteriological analysis during this survey of July 31, 1969.

In addition to this sanitary survey, a lake water survey was conducted along the Bruce Township shoreline by the Great Lakes Surveys Branch on August 11, 1969. A total of 14 lake samples were obtained at an average distance of 2,000 feet offshore for bacteriological analyses. The approximate locations of the sampling points, along with areas of adverse samples is depicted in Figure 16. All bacteriological and chemical analyses are listed in Appendix 8 and 9.

3. WATER SUPPLY

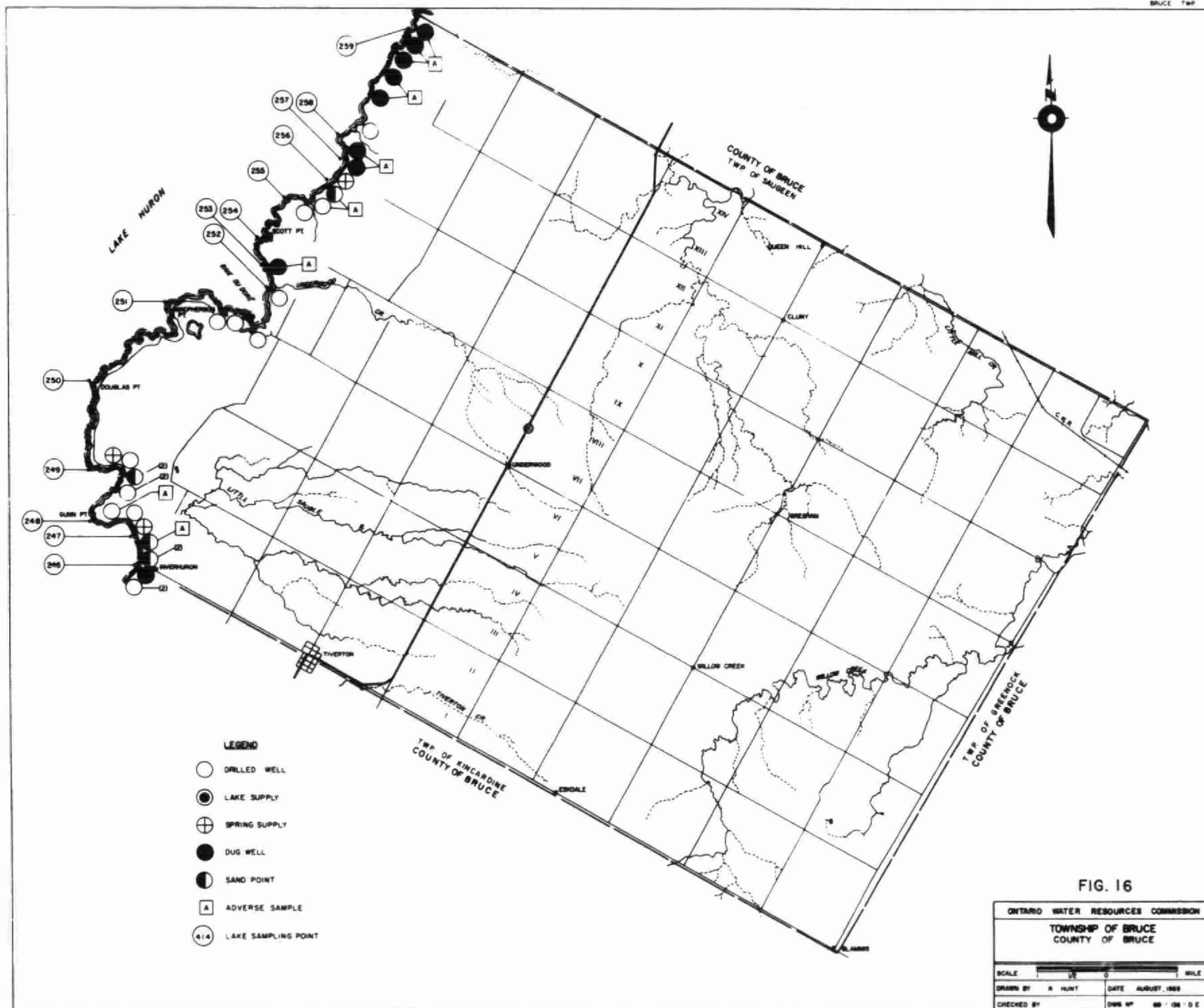
There are, at present, no municipally operated water supply systems in the township. However, there are a number of private water supply systems which have been established to serve the Hamlet of Underwood, the Douglas Point HEPC development, and several of the areas in which cottage properties are numerous. Details of these systems, as compiled from OWRC records are presented in Table 6 and indicate that the communal water supply systems provide satisfactory quality in every case.

TABLE 6

COMMUNAL WATER SUPPLIES IN THE TOWNSHIP OF BRUCE

LOCATION	OPERATOR	SOURCE	NO. OF SERVICES	CAPACITY (GPH)	TREATMENT	QUALITY*
UNDERWOOD	N.T. HOWE	DRILLED WELL	20	700	NIL	SATISFACTORY
DOUGLAS POINT	H.E. P.C.	LAKE HURON	400 PERSONS	N.A.	FILTRATION, CHLORINATION	SATISFACTORY
BATE DU DORE	H. MORGNER	INFILTRATION WELL	N.A.	N.A.	CHLORINATION	SATISFACTORY
HYDE-A-WAY RESORT	W. HYDE	DRILLED WELL	8	N.A.	N.A.	SATISFACTORY
GEE WATER WORKS	W. GEE	DRILLED WELL	6	N.A.	NONE	SATISFACTORY

* BASED ON 1969 RESULTS



There are additional water supplies at various trailer parks and summer camps as well as the provincial park (Inverhuron) which are examined by the local Health Unit at least twice a month. All such supplies are bacteriologically satisfactory according to records.

As far as private drinking water supplies are concerned, drilled wells were found to serve roughly 45 per cent of the residences examined. The well depths vary from 150 to 200 feet although some are less than 100 feet deep. This source of supply is the best in the township according to bacteriological results. A summary of the private water sources tested during the survey is presented in Figure 17. Notice that the per cent adverse samples are also indicated.

Dug wells cover another 30 per cent of the township drinking water supply. These supplies are characterized by a sulfur taste, high iron content and related dark colour. Some of these wells run dry during the summer months raising the problem of inadequate supply to meet the demand. The chemical quality of the major supplies and the appropriate OWRC objectives are presented in Figure 18.

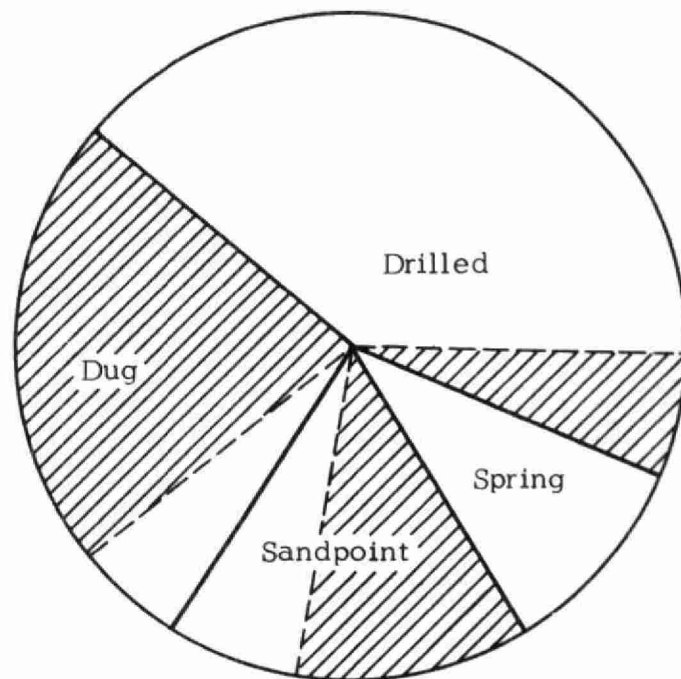
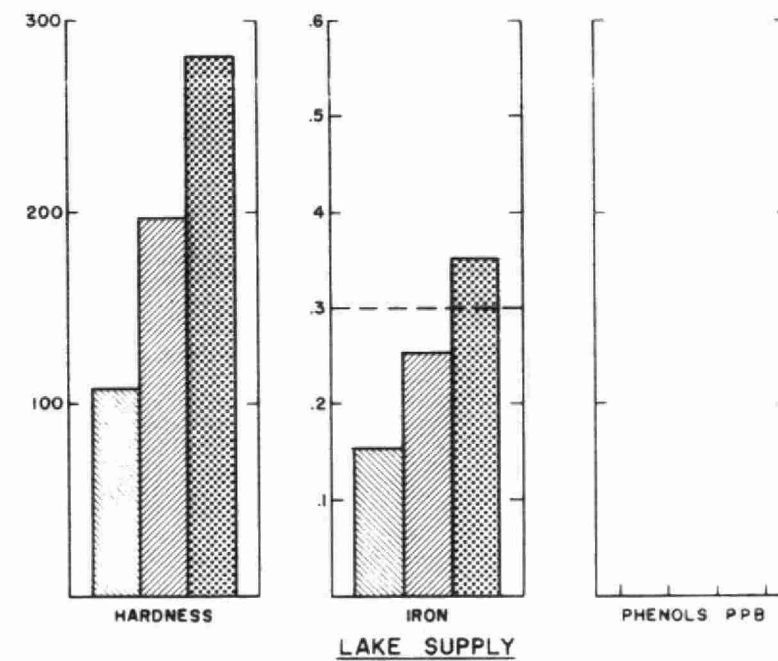
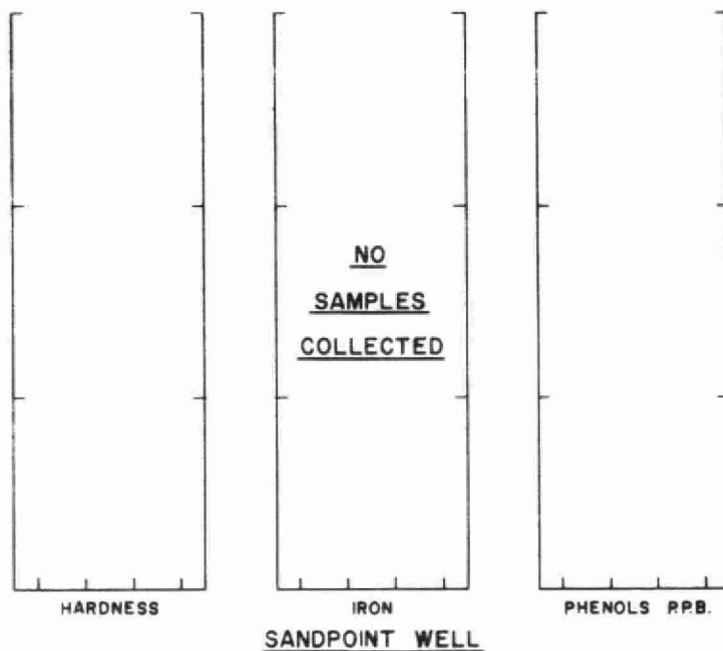
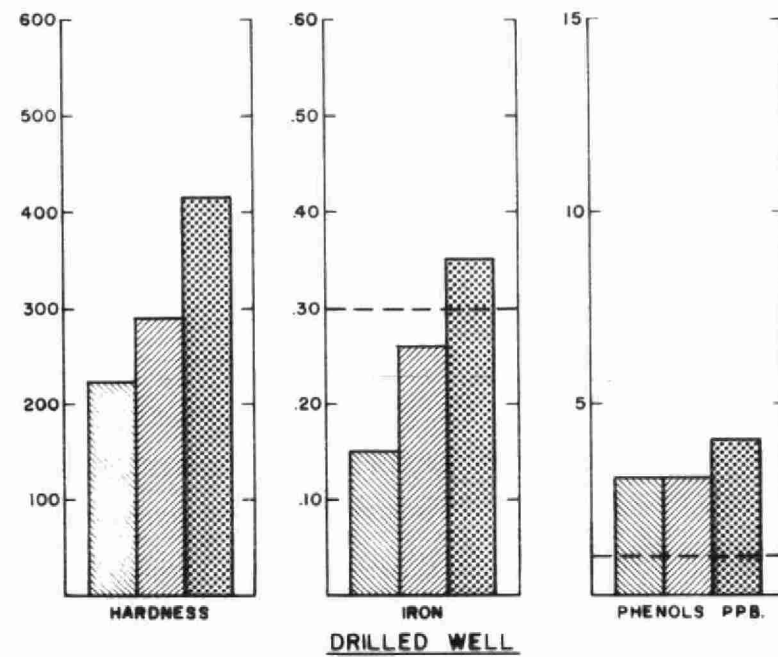
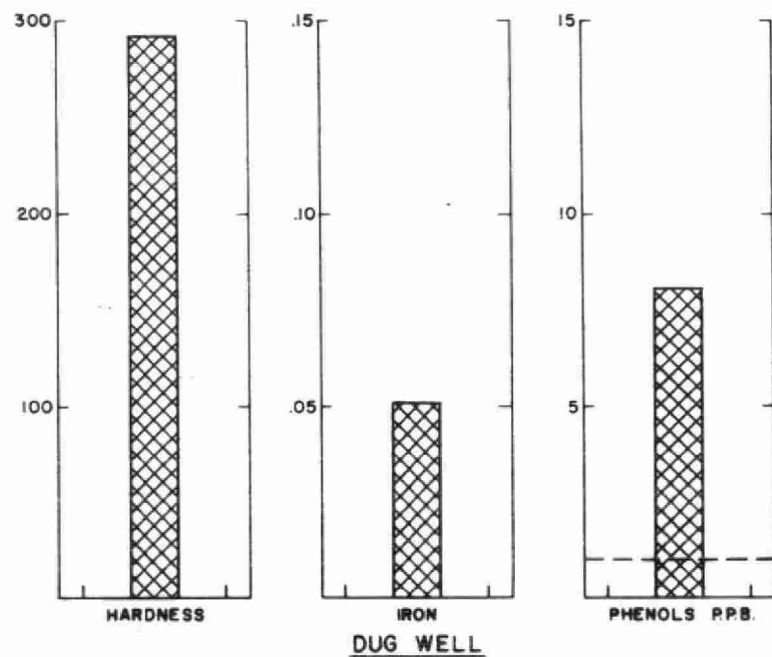


FIGURE 17
BRUCE TOWNSHIP

- distribution of water sources
/// indicates per cent adverse samples



----- OWRC RECOMMENDED LIMIT ----- IRON = .30, PHENOL = 1.0



MINIMUM VALUE



AVERAGE VALUE



MAXIMUM VALUE



SINGLE SAMPLE

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED

FIG. 18 BRUCE TOWNSHIP

Sandpoint supplies were found at 15 per cent of the residences visisted. The major complaint concerning these supplies is the sulfur taste. The remaining 10 per cent of the water sources are spring supplies.

4. WASTEWATER DISPOSAL

While there are no municipal sewage treatment facilities operating within the township at the present time, there are two treatment systems in operation, one at the Douglas Point HEPC development and the other at the Bruce Central School. System details for these two systems are as follows:

Douglas Point HEPC

Type of Treatment	-	0.5 acre 2 cell lagoon
Receiving Stream	-	Lake Huron
Population Served	-	present - 200-300 persons design - 75-100 persons

Bruce Central School

Type of Treatment	-	1 acre single cell lagoon
Receiving Stream	-	Underwood Creek
Population Served	-	present - roughly 250 persons design - 300 persons

With reference to private waste disposal systems in the township, it was found in the initial sanitary survey, that sewage disposal is achieved through septic tanks and tile beds in 90 per cent of the residences visited. Of the total number of septic tank systems, roughly 40 per cent had separate connections for

the sink and laundry wastes. The remaining 10 per cent of the waste disposal facilities consist of pit privys.

5. DISCUSSION

In sampling private water supplies, there were 14 drilled well supplies tested, of which 2 were found to be adverse. The adverse samples exhibited coliform bacteria counts of 8 and 2 per 100 ml. of sample which does not indicate a major pollution problem. Neither adverse sample showed a faecal organism count which would have indicated the presence of domestic sewage in the water supply. The OWRC considers water to be safe for human consumption if a total coliform count of 0 per 100 ml of sample is obtained from a water sample.

Testing of dug wells revealed that 80 per cent were bacteriologically unsatisfactory for human use. Total coliform bacteria counts as high as 92 per 100 ml. of sample are characteristic of the majority of this type of supply tested. Faecal counts from some of the samples indicate that domestic sewage is gaining access to these wells. A most likely source for these wastes is seepage from malfunctioning septic tanks or escaping sewage from the cesspools present on a number of lots. In some instances, it was found that these cesspools were only 30 feet from private wells and only 50 feet from the lake.

Of the residences visited, six were using sandpoint well supplies. Two of the six revealed coliform organism counts which were as high as 80+ per 100 ml. of sample. Although no faecal organism counts were found in these two samples, the high coliform counts do reveal problems exist with these supplies requiring that the water be boiled before use.

Cottage development along the lakeshore in Bruce Township is fairly well developed particularly in the area of Inverhuron Beach. This region is a relatively congested cottage area as many of the lots are small. Cottages along the shore are, in some cases, less than 75 feet from the water. During the survey, considerable ponding from septic tanks was noticed along the beach at Inverhuron. Sandy conditions similar to Sauble Beach prevail in this region and the evidence of ponding can be attributed to the congested development of the area.

The lake sampling showed the water to be in excellent condition and not unlike normal lake water quality. Relatively low coliform counts were exhibited by 50 per cent of the samples obtained.

6. CONCLUSIONS

It appears that the only problem area at present in the Township of Bruce is in the vicinity of Inverhuron Beach. Congested cottage development is causing the majority of the problems in this particular

location and communal water and sewage treatment facilities should ultimately be constructed here. In the interim, private septic tank and tile field disposal systems should be examined for operating difficulties and the water supplies should be examined for proper construction and the presence of sanitary seals.

7. RECOMMENDATIONS

1. The Inverhuron Beach area should be provided with a communal drilled well water supply system and sewerage services. The municipality should, in an orderly fashion, assume the ownership of all existing private communal supplies.

2. New development should be centered around those areas which are provided with services. The remaining sections should develop only if minimum population densities are permitted and individual well supplies and septic tank systems can be installed.

3. With regard to the northern section, the existing water supplies and disposal systems should be inspected and revamped where necessary to reduce the pollution problems noted. If correction cannot be accomplished by this means, communal systems should be installed.

4. All existing water supplies and sewage disposal systems should be inspected and revamped, where necessary, to alleviate the existing pollution problems.

5. In areas where services cannot be economically provided, development on individual services should be restricted to maintain minimum population density. Drilled wells are the preferred water supply source.

6. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 7

TOWNSHIP OF EASTNOR

	<u>PAGE</u>
1. GENERAL	77
2. FIELD SURVEYS	78
3. WATER SUPPLY	80
4. WASTEWATER DISPOSAL	83
5. DISCUSSION	83
6. CONCLUSION	86
7. RECOMMENDATIONS	87

TOWNSHIP OF EASTNOR

1. GENERAL

The Township of Eastnor is located in the middle of the Bruce Peninsula, bounded on the north by the Township of Lindsay, on the east by the waters of Georgian Bay, on the west by the waters of Lake Huron, and on the south by the Township of Albemarle. This township embodies a total land area of some 90 square miles of which 80-89 per cent represents occupied farm land.

The overburden of the western shoreline is a member of the Breypen series as was Lindsay and St. Edmund's Townships. As such, there is no particular soil type involved but pockets of muck or stony soil are scattered throughout the masses of bare bedrock. The interior of the township is composed of a sandy outwash over heavy till exhibiting very poor drainage. This soil type is a member of the Wauseon series and as such consists of a black loam over mottled sand over mottled clay till. The clay is usually reached at depths of three feet or less.

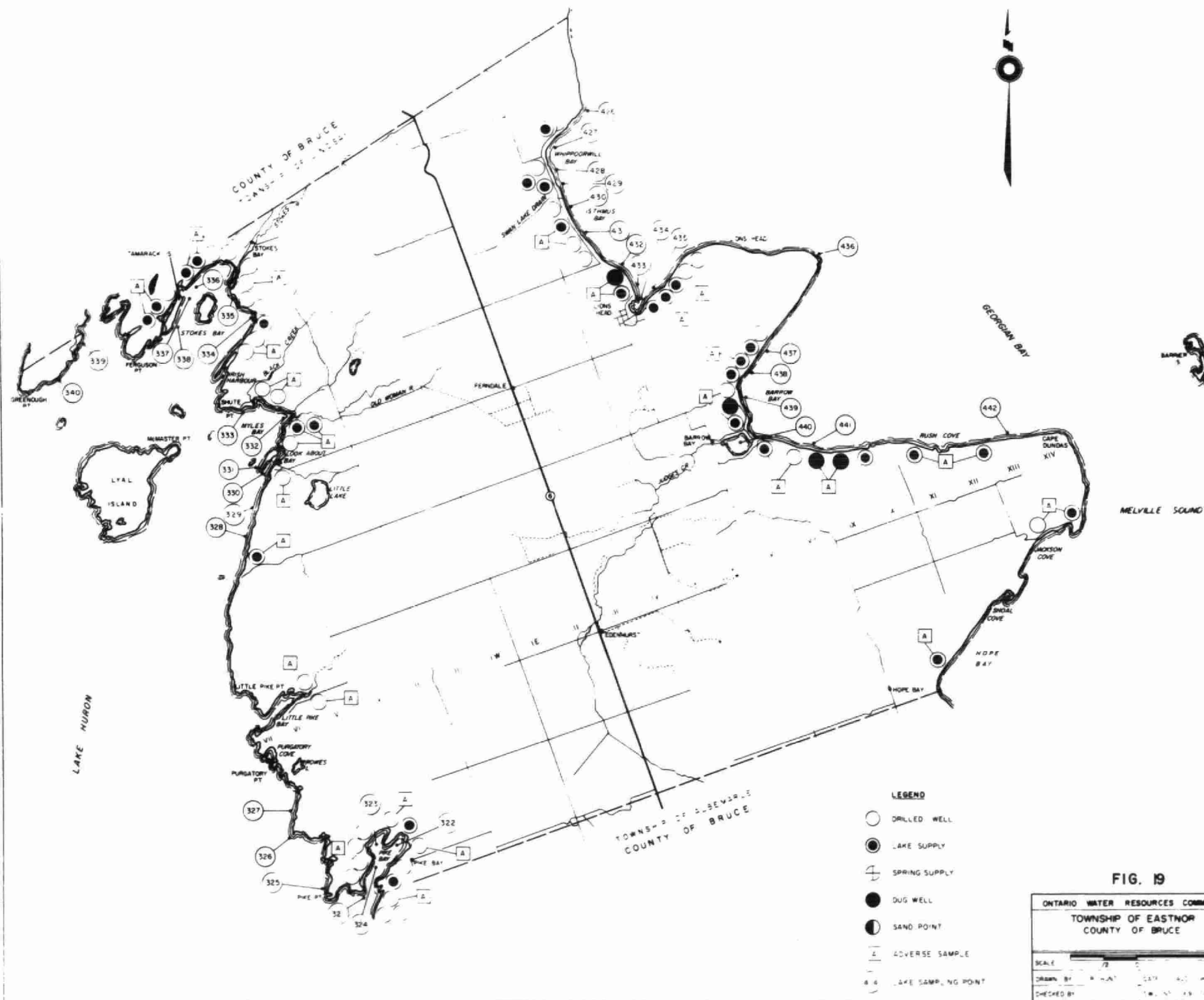
The permanent resident population for the township was 840 as per the 1968 census. Of this total, 432 are residents of the Village of Lion's Head located on the eastern shore of the Township at Isthmus Bay. These population figures fluctuate noticeably with the seasonal influx of tourists with increases in population of 600 - 800 per cent.

On an economic basis, the predominant occupation of the residents is farming usually of the mixed variety. The tourist trade and related retail services help to stabilize the economy of this township. Major cottage developments are found in the areas of Isthmus Bay, Stokes Bay, Myles Bay, Pike Bay and Barrow Bay. New cottage development is beginning in the area of French Harbour and Pine Tree Harbour.

2. FIELD SURVEYS

The field work involved in this pollution survey was carried out in the period from July 29 to August 8, 1969. A random sampling program was used to obtain a good cross-section of samples which would be representative of both the township shoreline water supplies. The sampling frequency therefore increased with the density of the cottage areas. Bacteriological samples were obtained at each visit and the approximate location of these supplies is depicted in Figure 19. Representative chemical samples were also obtained of the most common water sources.

On August 13, 15 and 19, 1969, a shoreline survey of the waters of Lake Huron and Georgian Bay was conducted by the Great Lakes Surveys Branch. The samples were taken at a distance of roughly 300 feet offshore and their approximate locations are also depicted in Figure 19.



3. WATER SUPPLY

Roughly 50 per cent of all water supplies used by cottagers on the eastern shores of the township are lake supplies. Drilled wells, averaging between 30 and 100 feet in depth, account for 30 per cent of the total supplies. Dug wells, varying in depth from 10 to 18 feet, and a few spring supplies, account for the remaining water sources. The majority of the lake supplies receive no treatment prior to consumption.

The majority of the water supplies found along the western shoreline of the township are drilled wells averaging 30 to 125 feet in depth. These supplies make up 75 per cent of all supplies whereas the waters of Georgian Bay account for another 20 per cent of the known supplies. Dug wells and springs make up the remaining 5 per cent.

At present, there are no known communal water supplies in the township, although in June 1969, an application was received by this Commission for the establishment of such a system for a planned subdivision.

The various sources of all shoreline water supplies sampled during the survey are summarized in Figure 20 which illustrates the per cent of all supplies tested. The corresponding per cent adverse samples for each supply are also summarized in this figure and a list of the actual counts obtained may be found in Appendix 10.

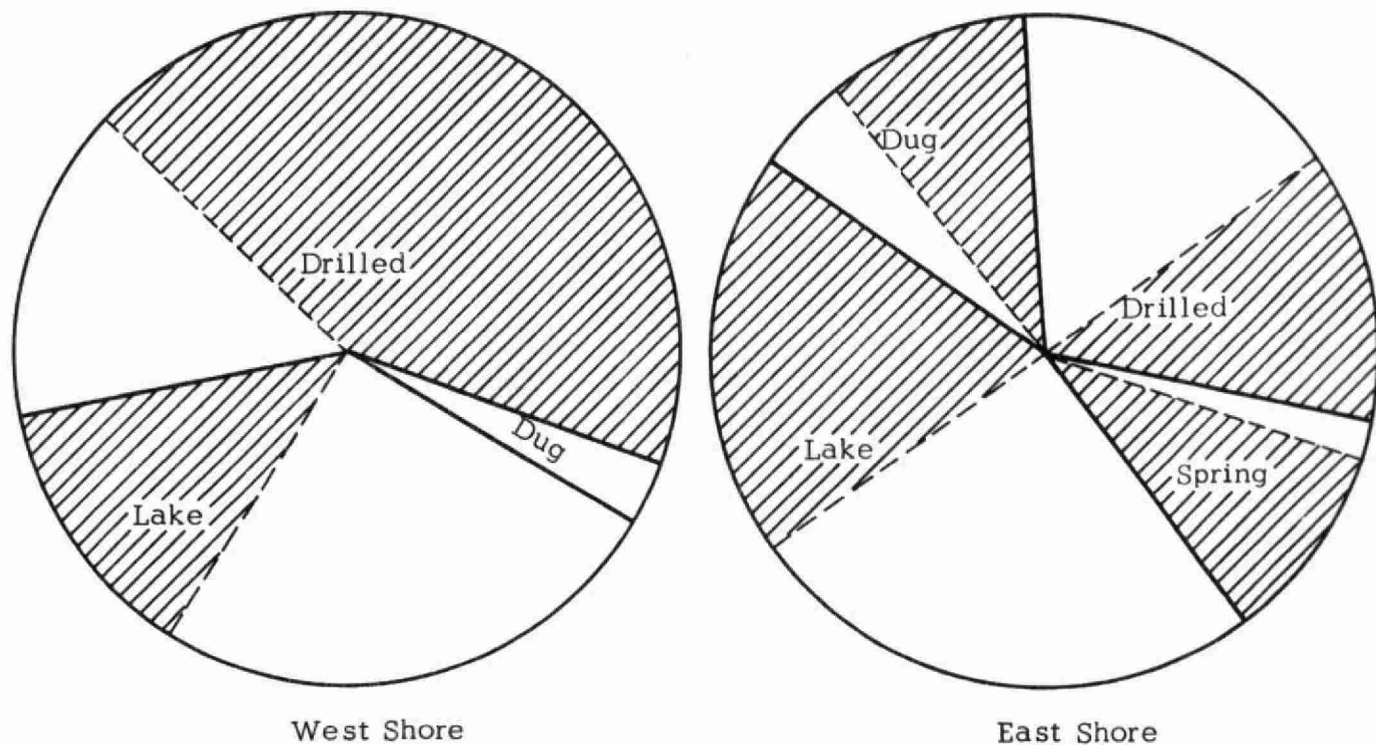
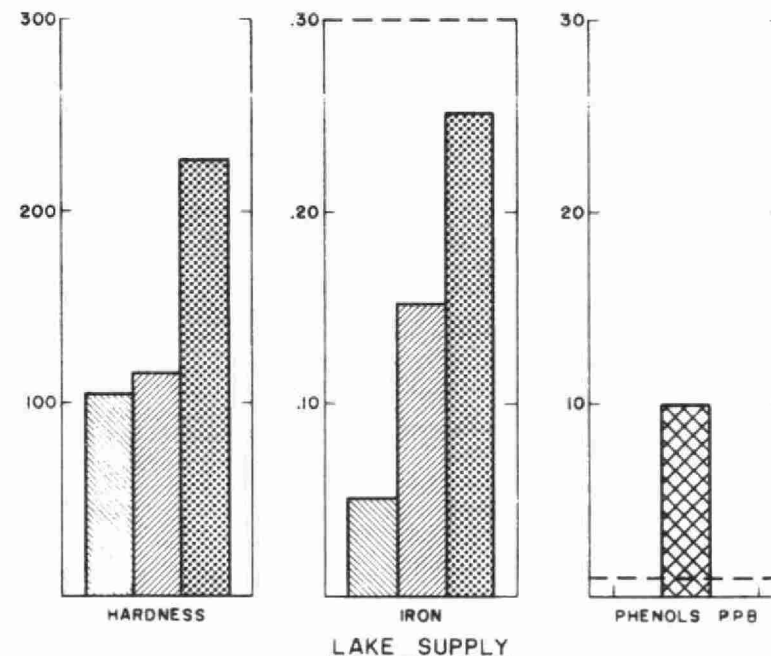
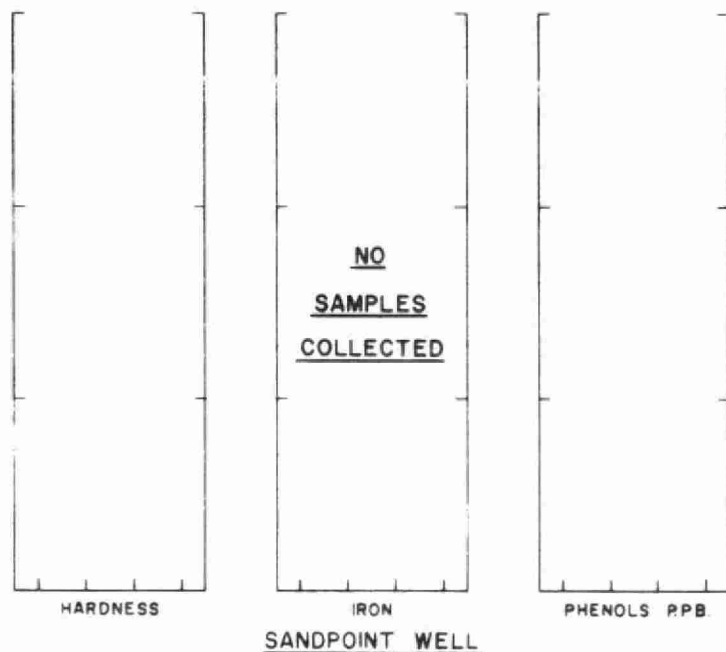
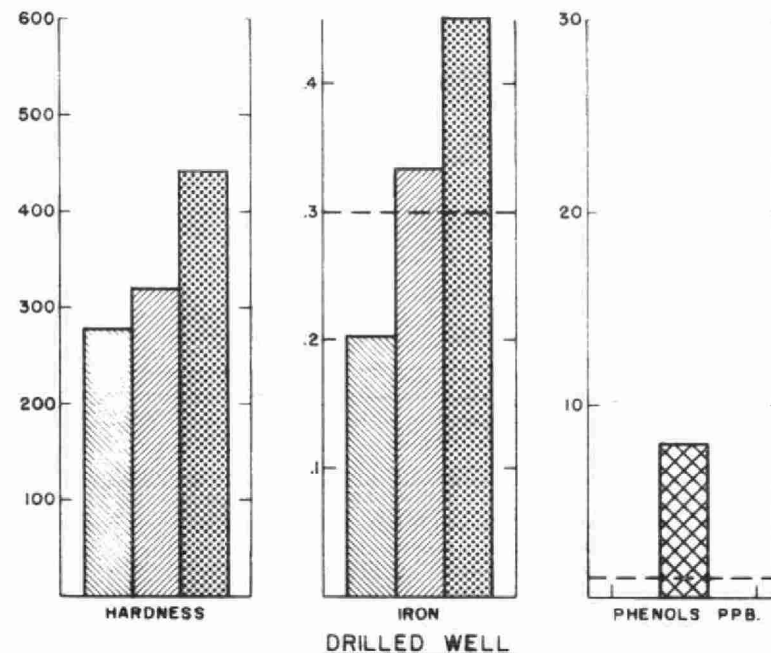
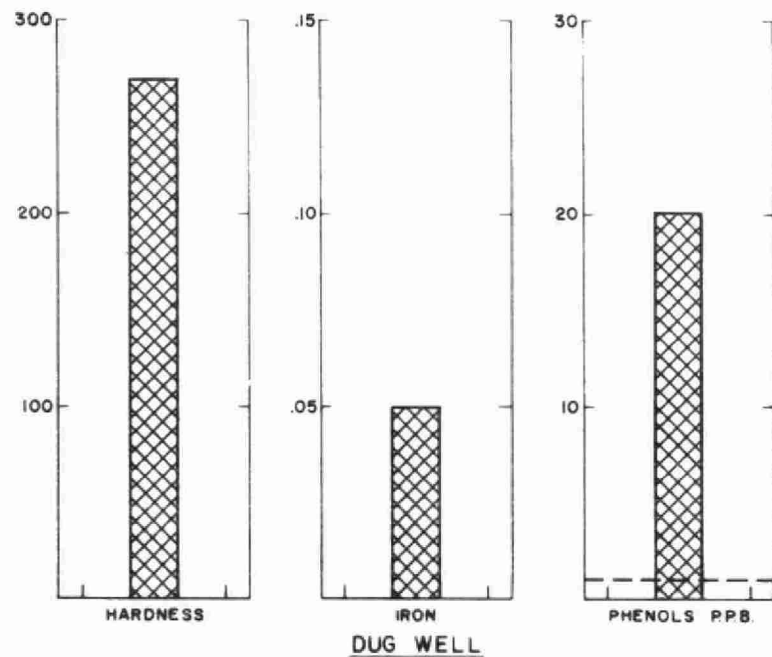


FIGURE 20
TOWNSHIP OF EASTNOR

- distribution of shoreline water supplies
/// indicates per cent adverse

The chemical results of the common water supplies tested are presented in Appendix 11 and summarized in Figure 21. The corresponding OWRC objectives for each parameter tested are also presented in this figure.



----- OWRC RECOMMENDED LIMIT ----- IRON = 30, PHENOL = 1.0

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED



MINIMUM VALUE



AVERAGE VALUE



MAXIMUM VALUE



SINGLE SAMPLE

FIG. 21 EASTNOR TOWNSHIP

4. WASTEWATER DISPOSAL

There are no communal sewage treatment facilities located in the township at the present time.

Individual sewage disposal is achieved through septic tank disposal systems which represent over 90 per cent of the facilities used along the eastern shores of the township and over 75 per cent of those used along the western shoreline. The remainder of the property owners still rely on pit privies as a means of disposing of domestic wastes.

5. DISCUSSION

In connection with the sanitary survey conducted along both east and west shorelines of the township, a total of 74 drinking water supplies were sampled, the test results showing that 42 of the 74 or 58.6 per cent were unsatisfactory and considered unsafe for human consumption. Total coliform counts as high as 80+ per 100 ml. of sample were recorded in drinking water samples taken from private cottages in the area. Water is considered safe for human consumption if the coliform count is 0 per 100 ml. of sample. Of these 42 adverse samples, 26 showed the presence of faecal coliform organisms. These organisms are usually inhabitants of the intestinal tract of warm-blooded animals and as such associated with the faecal discharges of same.

Their presence in a drinking water supply indicates domestic sewage is gaining access to the supply in some manner.

A total of 40 drilled wells were sampled during the survey and 26 of them were found to be adverse. Of the five dug wells sampled, three were found to contain coliform organisms. The most probable cause of these wells being polluted is that septic tanks and/or wells in the area are either improperly constructed or malfunctioning. The shoreline areas are very rocky, especially on the west side, making it very difficult to properly construct a septic tank disposal system. The lack of suitable soil to act as a filter results in raw wastes being transported to the water courses without treatment (filtering). This greatly affects the quality of the dug wells as they rely on infiltration for their water. With respect to the drilled wells, an improper or leaking seal placed on the well when first drilled will allow surface runoff water to enter the well and eventually contaminate the supply.

There were 29 samples taken from cottages using Lake Huron or Georgian Bay as their water supply. Of this total, 19 samples were found to be adverse by virtue of coliform bacteria counts. These lake supplies receive no treatment prior to use. However, most people using the supplies realize that untreated lake water is unsafe to drink.

Results of the shoreline boat survey indicate that the lake water is generally in excellent condition. A total of 31 lake water samples

were taken at an average distance offshore of 300 feet. Low coliform counts were obtained from 58.1 per cent of the samples. The coliform counts obtained were normal for lake water. It should be noted, however, that all surface lake supplies should be boiled for a minimum of 10 minutes prior to use.

The western shoreline of the township has three relatively well developed cottage areas in Stokes Bay, Myles Bay and Pike Bay. Because the overburden associated with the cottage sites is undesirable for the installation of septic tank systems, a critical water quality problem presently exists. The majority of all drilled wells and lake supplies sampled contained the presence of coliform bacteria with faecal coliforms being common in many of these sources as well. It is essential that all well supplies in these areas be examined for proper operation and revamped, if necessary. Similarly, the existing septic tank systems should be examined and repaired, if required. Further development here should be restricted unless communal water and sewage treatment systems are installed. Meanwhile, all water supplies should be disinfected prior to consumption and serious consideration should be given towards installing a communal water supply system as soon as possible.

The eastern shoreline is faced with a similar problem along the shoreline of Whippoorwill Bay, Isthmus Bay and Barrow Bay. Communal domestic services should be provided in this area also and future

development should not be permitted unless the appropriate corrective measures have been installed.

6. CONCLUSIONS

It would seem then, that at the present time, the Lake Huron waters along the township are generally in excellent condition. However, future development can lead to a major pollution problem if proper development controls are not taken. One of the immediate controls can be the establishment of a minimum lot size for spotted development areas. However, as development becomes more dense, as in the case in Stokes Bay, Myles Bay, Isthmus Bay and Barrow Bay areas, communal water and sewage treatment facilities must be installed.

From the sample results, it seems that the poorest supplies are the dug wells followed closely by the drilled well supplies. It appears that the prime cause of the pollution of these supplies is domestic sewage gaining access to the supply from improperly constructed or malfunctioning septic tank disposal systems and improperly sealed wells. The onus is on the individual to ensure that his own waste disposal practices are adequate and that he is not contributing to the local pollution.

7. RECOMMENDATIONS

1. The Barrow Bay and the Whippoorwill Bay shore areas should be provided with communal water and sewerage services. The water supply should be from Georgian Bay. The Pike Bay, Myles Bay and Stokes Bay areas should be provided with communal water and the existing disposal systems inspected and revamped, where necessary.

2. New development should be centered around those areas which are provided with services. The remaining sections should develop only if minimum population densities are permitted and individual well supplies and septic tank systems can be installed.

3. Filled lots should not be considered unsuitable for the installation of septic tank and tile field systems.

4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 8

TOWNSHIP OF HURON

	<u>PAGE</u>
1. GENERAL	89
2. FIELD SURVEYS	90
3. WATER SUPPLY	90
4. WASTEWATER DISPOSAL	95
5. DISCUSSION	95
6. CONCLUSION	96
7. RECOMMENDATIONS	96

TOWNSHIP OF HURON

1. GENERAL

The Township of Huron is located at the southern extremity of Bruce County bounded on the north by the Township of Kincardine, on the east by the Township of Kinloss, on the south by Huron County, and on the west by the waters of Lake Huron. This township encompasses a total land area of 94.29 square miles of which over 90 per cent is used for mixed farming.

According to the 1968 census, the permanent resident population of the township is 1,370. With the flow of tourists into the area during the summer season, this population figure increases by several hundred per cent. The Village of Ripley is the only large centre of population density in the township hosting a population of 406 permanent residents.

The soil conditions of the shoreline area are mainly sandy being a member of the Sullivan series. As such, this soil exhibits good natural drainage. The interior regions of the township are covered predominantly by the Brookston series of heavy textured till. This series is noted for its poor natural drainage characteristics as the surface soils are mainly clay or clay derivatives.

The soil conditions of the township interior account for the fact that general mixed farming forms the basis of the local economy.

Grain crops flourish on this land particularly in the regions which are well drained. As is common throughout the County, the local economy of this township is also stabilized by the tourist industry and its related retail services.

2. FIELD SURVEYS

A small number of private drinking water supplies were sampled on July 30, 1969. As most of the supplies in the area are communal supplies, only three private supplies were actually sampled.

In addition to the small sanitary survey, a survey of the lake water along the Huron Township coastline was carried out by the Great Lakes Surveys Branch, OWRC on August 6, 1969. A total of 24 water samples were obtained for analysis at that time.

The bacteriological and chemical analyses of water samples obtained during the surveys are listed in Appendix 12 and 13 respectively. The approximate sampling locations and adverse water supplies are depicted in Figure 22.

3. WATER SUPPLY

There are presently no municipally owned and operated communal water supply systems in Huron Township.

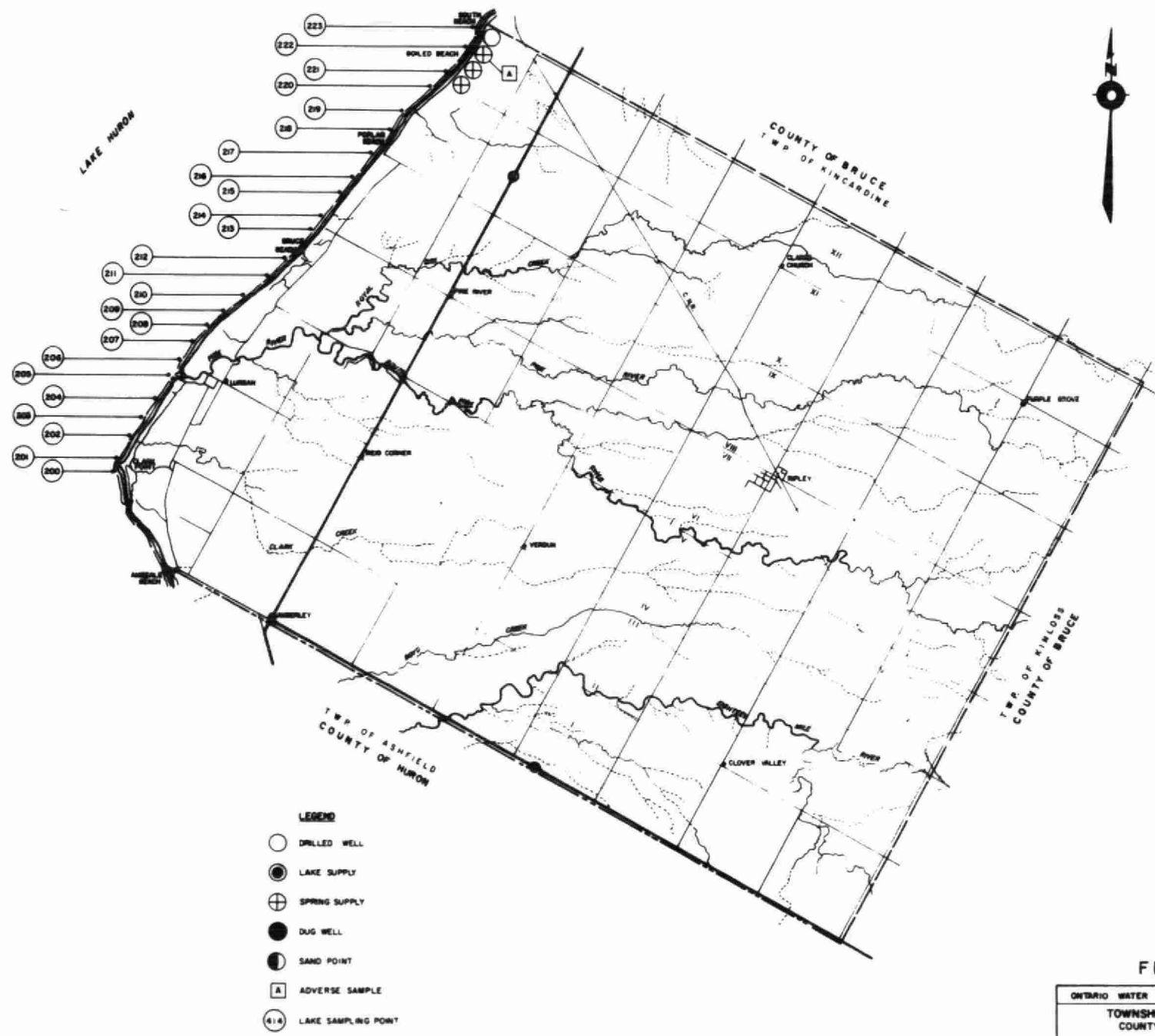


FIG. 22

ONTARIO WATER RESOURCES COMMISSION	
TOWNSHIP OF HURON COUNTY OF BRUCE	
SCALE: 1/2" = 1 MILE	DATE: JULY, 1988
DRAWN BY: R. HUNT	FILE NO.: 85-188-0-2

The door-to-door sampling program as carried out in the other townships was not carried out in Huron Township at the request of the Health Unit. The reason for this is that the majority of the cottages in the township are served by private communal supplies inspected regularly by the Health Unit. All such supplies were satisfactory and producing water safe for human consumption. The only exception to this is Boiler Beach area where some door-to-door sampling of private water supplies was carried out. Table 7 summarizes the OWRC inspected communal systems in operation in Huron Township.

As indicated in Table 7, the majority of water supplies in this township are drilled wells. Figure 23 summarizes the various types of water sources commonly in use as a percentage of the total and indicates the percentage of adverse samples associated with each source.

The drilled well and lake water qualities are indicated in Figure 24 and indicate that the phenol concentration in the latter is quite high.

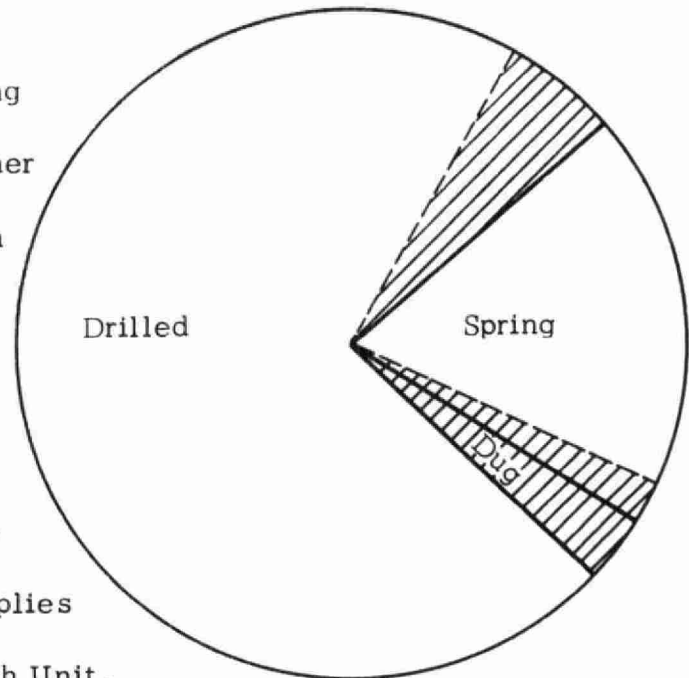


FIGURE 23: HURON TOWNSHIP

- distribution of shoreline -
water supplies

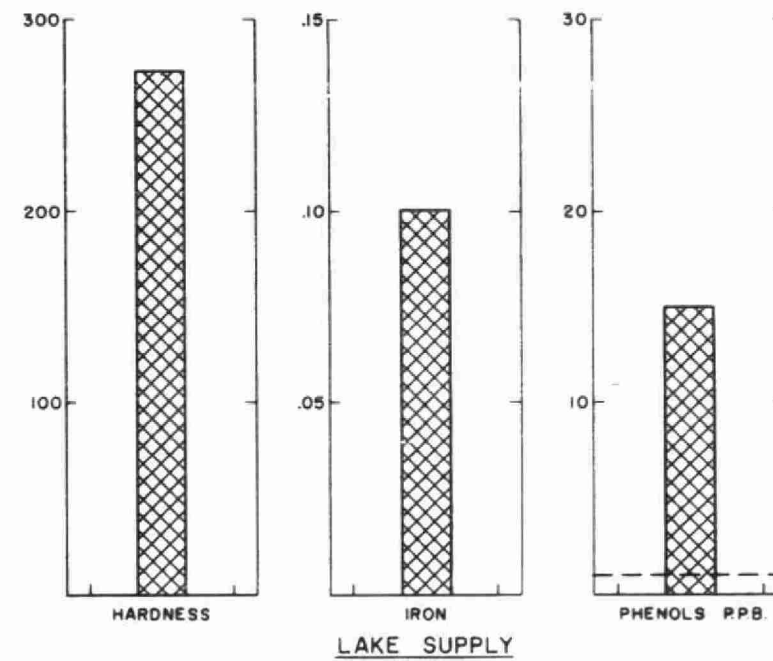
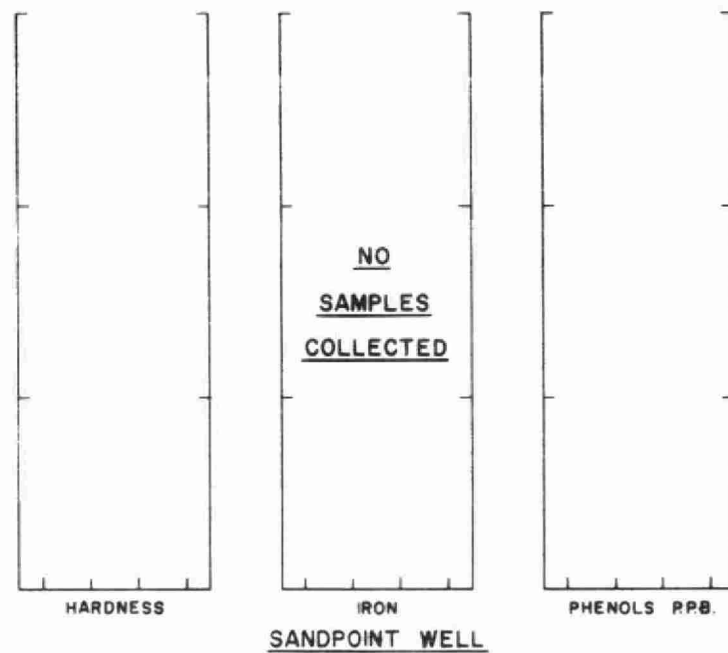
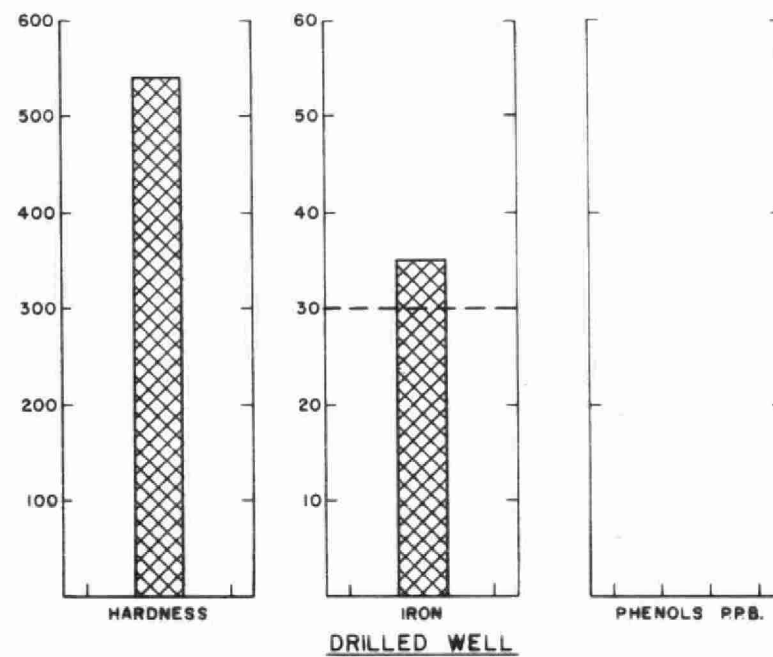
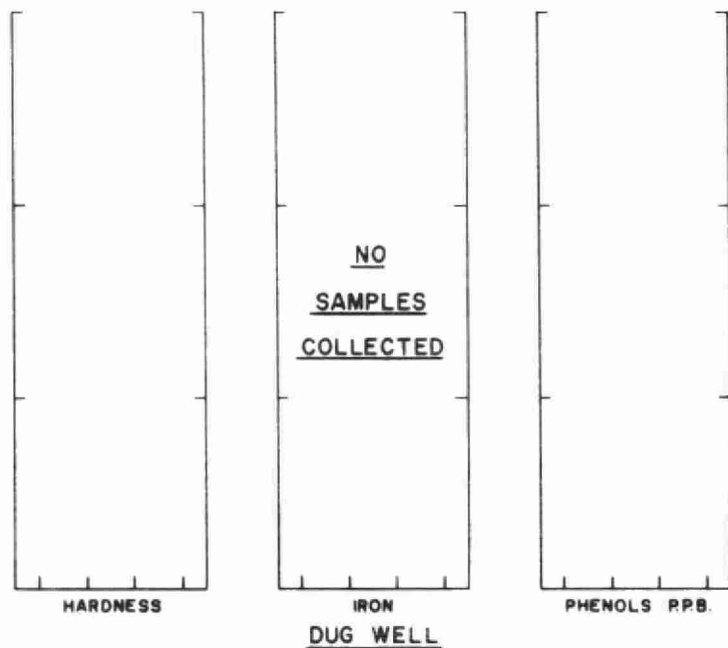
/// indicate per cent adverse

TABLE 7

COMMUNAL WATER SUPPLIES IN THE TOWNSHIP OF HURON

SYSTEM	OPERATOR	SOURCE	NO OF SERVICES	CAPACITY (GPH)	TREATMENT	QUALITY*
AINTREE TRAILER CAMP	T. BOYER	DRILLED WELL (217')	93	720	NONE	SATISFACTORY
BERG W.W.	W. BERG	DRILLED WELL (215')	18	N.A.	NONE	SATISFACTORY
BOILER BEACH CAMP	G. CASE	DRILLED WELL (209')	96	1200	NONE	SATISFACTORY
BRENNOR W.W.	R. BRENNOR	DRILLED WELL (207')	28	N.A.	NONE	SATISFACTORY
BRUCE BEACH WELL FUND	J. WILLOUGHBY	DRILLED WELL (265')	14	N.A.	NONE	SATISFACTORY
BRUCE BEACH SUBDIVISION	H. EASTMAN	DRILLED WELL (246')	18	2100	NONE	SATISFACTORY
ELLIOT W.W.	G. ELLIOT	ARTESIAN WELL (201')	8	N.A.	NONE	SATISFACTORY
KENNEDY W.W.	D. KENNEDY	SPRING	17	500	CHLORINATION	SATISFACTORY
LATTNER W.W.	A. LATTNER	DRILLED WELL (170')	8	N.A.	NONE	SATISFACTORY
LEONARD W.W.	W. LEONARD	ARTESIAN WELL (175')	17	N.A.	NONE	SATISFACTORY
MACKENZIE W.W.	A. MACKENZIE	DRILLED WELL (228')	33	1200	NONE	SATISFACTORY
MCCALLUM W.W.	J. MCCALLUM	ARTESIAN WELL (197')	21	N.A.	NONE	SATISFACTORY
NORTH BRUCE BEACH WATER ASS'N.	A. BOSKINS	DRILLED WELL (215')	14	550	NONE	SATISFACTORY
OHLEISER W.W.	H. OHLEISER	DRILLED WELL (230')	5	N.A.	NONE	SATISFACTORY
O'HARA W.W.	MR. O'HARA	DRILLED WELL (215')	8	N.A.	NONE	SATISFACTORY
PINE RIVER SYNDICATE	MR. DURNIN	DRILLED WELL (210')	15	N.A.	NONE	SATISFACTORY
ROSINKI W.W.	MR. ROSINKI	DRILLED WELL (207')	7	5400	NONE	SATISFACTORY
ROTTEAU W.W.	MR. P. ROTTEAU	DUG WELL	10	N.A.	CHLORINATION	SATISFACTORY
SOUTH BRUCE BEACH	JR. G. WILSON	ARTESIAN WELL (216')	12	N.A.	NONE	SATISFACTORY
THE 40'S W.W.	MR. T. LYND	DRILLED WELL (200')	10	N.A.	NONE	SATISFACTORY

* BASED ON 1967 RESULTS



--- OWRC RECOMMENDED LIMIT --- IRON = 30, PHENOL = 1.0



MINIMUM VALUE



AVERAGE VALUE



MAXIMUM VALUE



SINGLE SAMPLE

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED

FIG. 24 HURON TOWNSHIP

The drilled well water is excessively hard and contains iron in concentrations exceeding the OWRC limit of 0.3 ppm for drinking water supplies.

4. WASTEWATER DISPOSAL

The majority of the cottages in the township, approximately 90 per cent, employ septic tank and tile bed waste disposal systems. The remaining 10 per cent consists of pit privies which are still in use in various sections of the township. The Bruce County Health Unit reports no known sewage problems in this township. Soil conditions in the area are suitable for septic tank waste disposal systems and can account for the absence of any domestic pollution problems in the area.

5. DISCUSSION

Of the three samples taken during the sanitary survey, only one was found to be adverse. This supply was untreated spring water which exhibited both a high coliform count as well as a high faecal coliform count. Surface runoff was most likely the prime source of pollution of this supply.

Of the 24 lake water samples taken, 62.5 per cent exhibited coliform organism counts, all of which were in the region considered

acceptable for surface waters. The samples were taken offshore at an average distance of 1,000 feet.

Results of surveys conducted in the township do not indicate any major pollution problems in the township at the present time. However, the Boiler Beach area could develop problems similar to those of Sauble Beach or Inverhuron Beach if future development is not properly controlled. An official plan and associated by-laws should be adopted to ensure proper development of the shoreline areas in the future. Meanwhile, special care should be taken to locate new cottages on large lots to allow proper operation of the associated septic tank and tile field systems.

6. CONCLUSIONS

At present there are no serious water supply or pollution problems in the township. However, efficient planning through the use of an official plan and associated by-laws is required to ensure proper development of the shoreline in the future years.

7. RECOMMENDATIONS

1. The development of future sub-divisions in the township should continue on the basis of communal deep well supplies and, where possible, existing and future sources should be integrated.

The municipality should, in an orderly fashion, assume the ownership of all existing private communal systems.

2. The use of septic tank and tile field disposal systems can be continued in the township provided proper lot size, on which it is shown that these systems can be installed, and limited density of development is adhered to.

3. All existing water supplies and sewage disposal systems should be inspected and revamped where necessary, to alleviate the existing pollution problems.

4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 9

TOWNSHIP OF KINCARDINE

	<u>PAGE</u>
1. GENERAL	99
2. FIELD SURVEYS	101
3. WATER SUPPLY	101
4. WASTEWATER DISPOSAL	104
5. DISCUSSION	106
6. CONCLUSION	108
7. RECOMMENDATIONS	108

TOWNSHIP OF KINCARDINE

1. GENERAL

The Township of Kincardine is located in the southern portion of Bruce County bordered on the north by the Township of Bruce, on the east by the Townships of Greenock and Kinloss, on the south by the Township of Huron, and on the west by the waters of Lake Huron. The township covers a total land area of 94.49 square miles of which roughly 90 per cent represents occupied farm land.

The interior of the township is covered predominantly by a heavy textured till of the Perth series. The major soil group is the grey-brown Podzolic. This particular overburden exhibits imperfect drainage being characterized by dark grey clay loam lying over a number of different clay strata. This soil type lends itself best to general farming use although crop production is limited, to some extent, by inadequate drainage. The Kincardine shoreline is predominated by an overburden of well-sorted outwash of the sandy Sullivan series. This surface cover extends from the northern reaches of the township south to the Town of Kincardine municipal boundary. At this point the surface soil changes to the Fox series which is a sandy loam. Occurring on smooth gently sloping topography, the Fox series is a well-drained soil exhibiting characteristics of the grey-brown Podzolic

great soil group. The Sullivan series is considered to be a grey-brown Podzolic intergrade. The topography is smooth gently sloping and the drainage is good. Owing to the fact this soil is low in phosphorus, potassium, and organic matter, it has a low level of natural fertility.

Economically speaking, the township's growth in the past 20 years has been greatly affected by the development of some 300 cottages and tourist properties along the Lake Huron shoreline. Prior to this development, the local economy was based largely on agricultural land use. No major industries are located in the township although the Town of Kincardine's economy relies on several light manufacturing concerns. Similarly, the Village of Tiverton, as a retail centre has been affected by the large number of summer residents and by its proximity to the HEPC development at Douglas Point.

The Ontario Water Resources Commission conducted a water pollution survey in the Township of Kincardine on October 21, 1964. The results of this survey indicated that improper sewage disposal methods were being practised in the Village of Tiverton resulting in the pollution of a local creek. In addition, the location of the township dump site was questioned as it posed a potential threat of pollution of the Penetangore River. As a result of the survey, it was recommended that the refuse dump be relocated and that the village take steps to prevent the discharge of domestic sewage to the local creek at Tiverton.

2. FIELD SURVEYS

The field work involved with this township pollution survey was carried out by the OWRC during the period of July 28 to July 30, 1969 and consisted of a random door-to-door sampling of private drinking water supplies. A total of 17 residences were visited and samples were obtained for bacteriological analysis from each.

A survey of the Lake Huron water was carried out along the Kincardine shoreline by the Great Lakes Surveys Branch, OWRC on August 6 and 11, 1969. A total of 22 water samples were obtained at an average distance of 1,000 feet offshore along the entire shoreline.

All bacteriological and chemical analyses are presented in Appendix 14 and 15 respectively, and the approximate sampling locations, with an indication of the adverse samples, are presented in Figure 25.

3. WATER SUPPLY

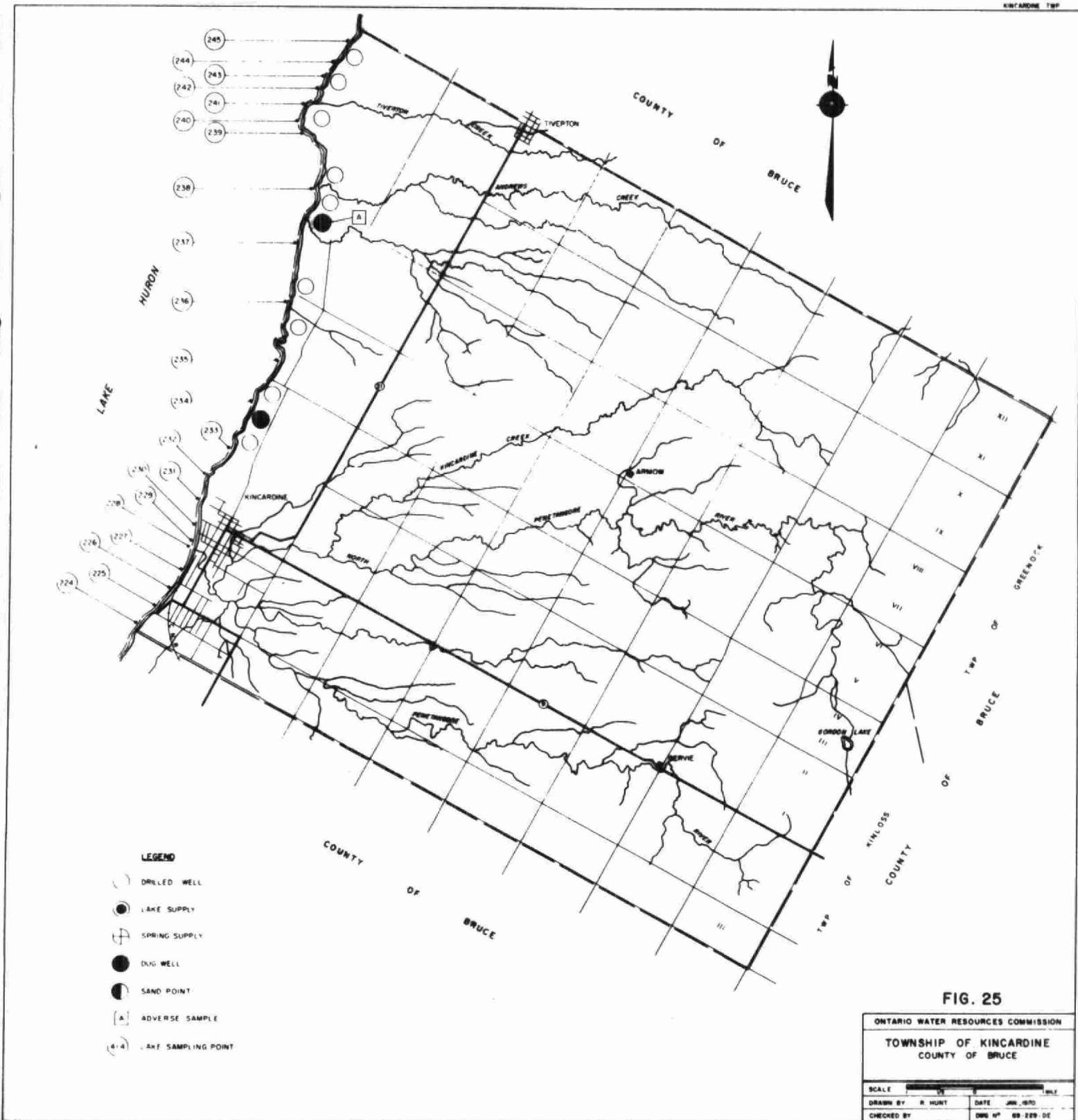
At present, there are no municipally-owned water supply systems in operation within the township. However, there are a number of private water systems located in various developed areas of the township. Such systems are serving the Hamlets of Arrow and Bervie and several summer cottage settlements. Details of these systems, as found in Commission records are listed in Table 8.

TABLE 8

COMMUNAL WATER SUPPLIES IN THE TOWNSHIP OF KINGARDINE

SYSTEM	OPERATOR	SOURCE	N.O. OF SERVICES	CAPACITY (GPH)	TREATMENT	QUALITY *
HAMLET OF ARMOW	ARMOW WELL CO-OPERATIVE (S. HUNTER, TREAS.)	DRILLED WELL (200')	14	700	NONE	SATISFACTORY
HAMLET OF BERTIE	E. MCGELLAN	DRILLED WELL (86')	N.A.	N.A.	NONE	GENERALLY SATISFACTORY
BIRRELL W.W.	W.V. BIRRELL	DRILLED WELL (101')	13	790	NONE	SATISFACTORY
CEDAR TERRACES W.W.	CEDAR TERRACES LTD. (R.G. BUCKINGHAM, SECRETARY)					SATISFACTORY
EDWARDS W.W.	F. EDWARDS	DRILLED WELL (84')	8	310	NONE	SATISFACTORY
LIME KILN LODGE	LIME KILN LODGE (MRS. M. GRUMET)	DRILLED WELL (80')	30	N.A.	NONE	SATISFACTORY

* BASED ON 1969 RESULTS



Private drinking water was obtained from drilled wells in 80 per cent of the residences visited. These wells varied in depth from 100 to 400 feet with the average depth approximately 200 feet. Dug wells and lake water supplied drinking water to the remainder of the residences visited. From a bacteriological standpoint, the drilled wells were the best water supplies in the township.

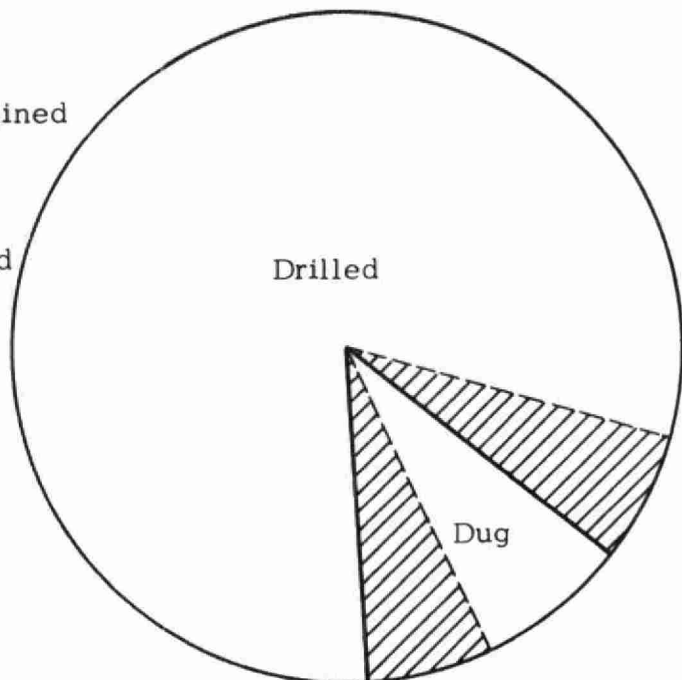
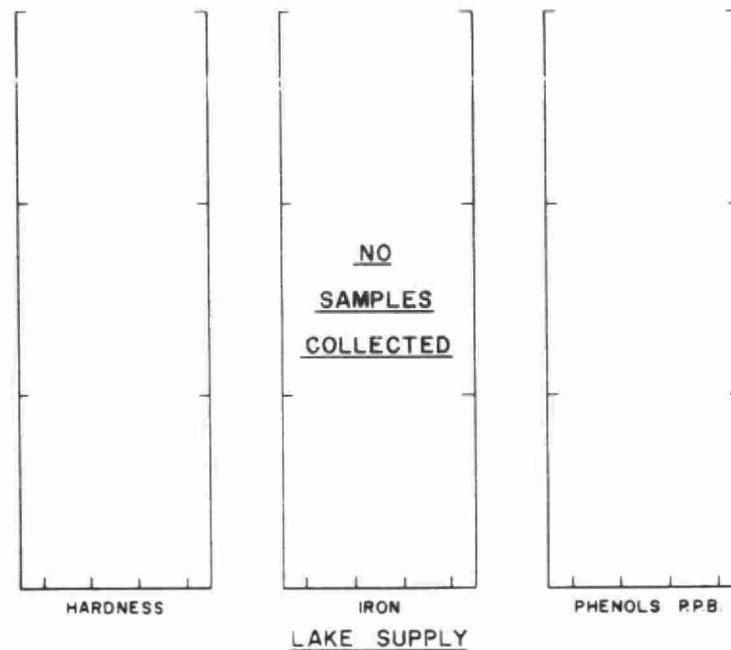
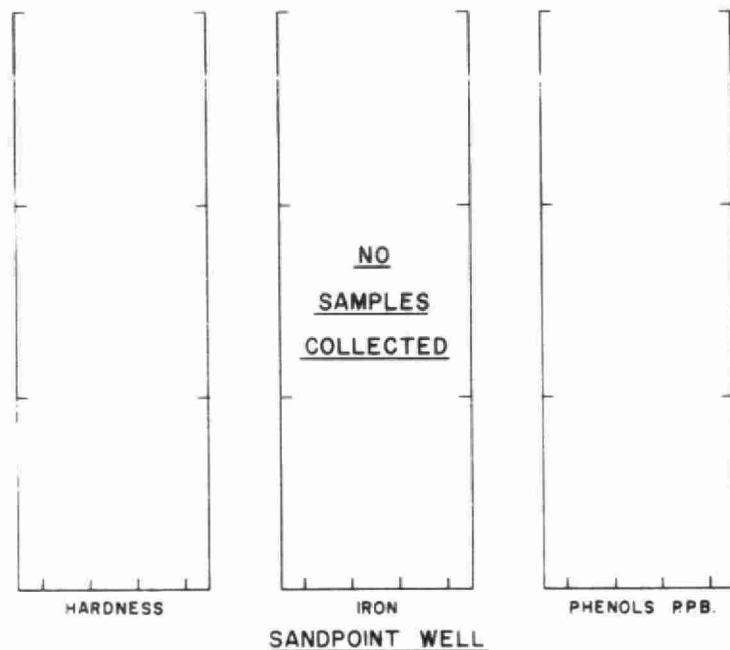
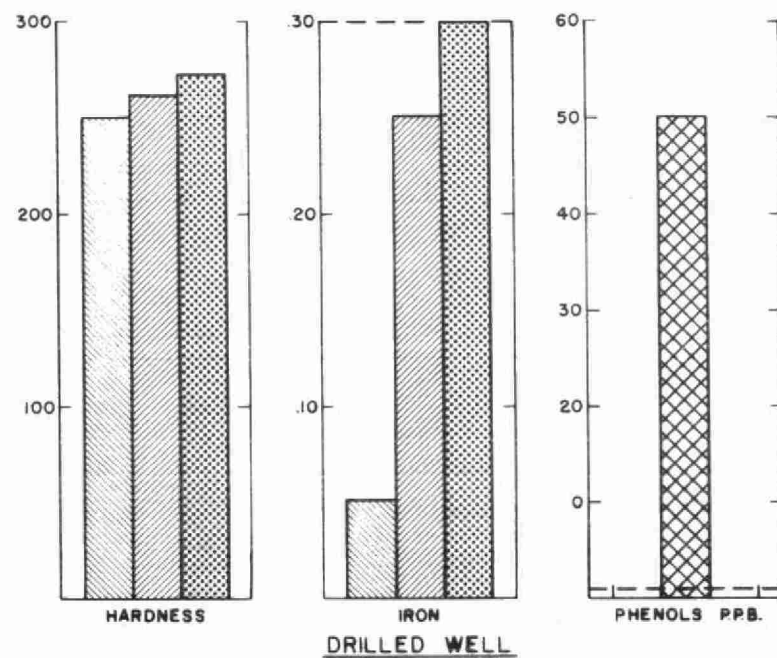
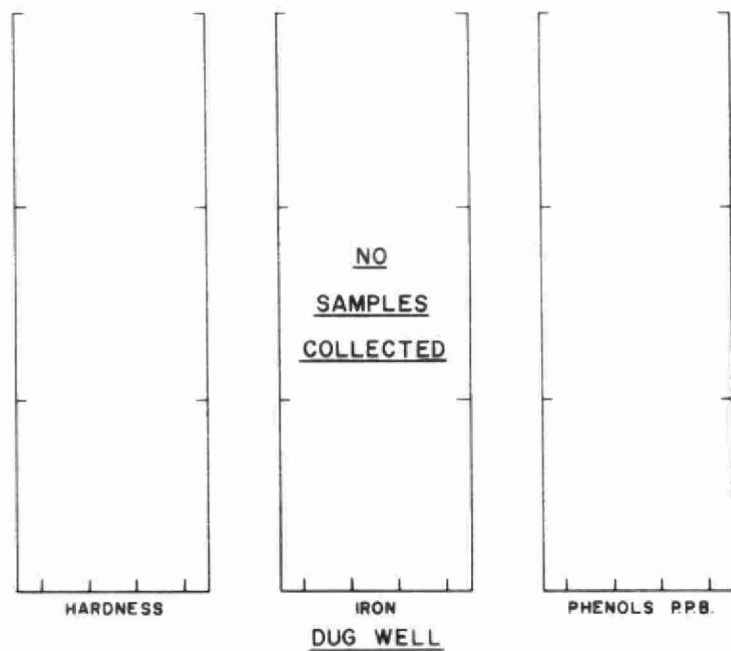


FIGURE 26 - TOWNSHIP OF KINCARDINE
- distribution of water sources -
/// indicates per cent adverse

A summary of the percentage of dug and drilled well supplies is presented in Figure 26 which also indicates the percentage of adverse samples for each source. The chemical qualities of representative drilled wells in the township are summarized in Figure 27. The water is hard and contains an excessive amount of phenols.

4. WASTEWATER DISPOSAL

There are no municipal sewage systems and treatment facilities in the township. The disposal of domestic wastes in all locations of the township is left to the individual property owner and in 90 per cent of those residences



----- OWRC RECOMMENDED LIMIT ----- IRON = 30, PHENOL = 1.0

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED

MINIMUM VALUE

AVERAGE VALUE

MAXIMUM VALUE

SINGLE SAMPLE

FIG. 27 KINCARDINE TOWNSHIP

visited, consisted of septic tank and tile bed systems. The remaining 10 per cent were still relying on pit privys or cesspools as a means of disposing of their domestic wastes. Approximately 25 per cent of the septic tank systems had separate connections for the sink and laundry wastes. Septic tank systems in the Inverhuron Beach region use seepage pits rather than tile beds due to the presence of tree roots in the area.

No immediate disposal problems are foreseen in this area. If large subdivisions are planned for the future (especially in the Inverhuron area), they should be strategically located so that effective use of the domestic water and sewage facilities serving the Town of Kincardine may be made.

5. DISCUSSION

Drilled wells supplied the drinking water for the majority of the residences visited during the sanitary survey. Of the 13 wells tested, only one was found to exhibit a coliform organism count. The adverse result may have been due to improper sampling procedure. Nonetheless, it can safely be said that the drilled wells in the area are excellent supplies.

Although dug wells are few in number in this township, it was possible to sample two of them and find that one was polluted.

Total coliform and identical faecal counts of 80+ per 100 ml. of sample indicate that supply to be harmful to human health. The presence of a faecal organism count supplies evidence of domestic sewage in the water supply. The source of such contamination could possibly be from an improperly constructed or malfunctioning septic tank system or dug well.

The lake water survey failed to show any evidence of severe pollution. Even though coliform counts were exhibited by 63.6 per cent of the water samples, the counts were not unlike those normally considered acceptable for surface waters.

The Inverhuron area is becoming more heavily populated and this may necessitate the installation of communal water and sewage treatment facilities. Ponding of septic tank effluent was observed near the Huron township area during this survey. Future building in this immediate area should be planned properly, through an official plan and associated by-laws, and the feasibility of utilizing the Kincardine municipal services should not be overlooked.

The use of communal water supplies in the township has supplied the consumers with an acceptable water supply and future installation of this type is encouraged. Municipal ownership is requested in each case to facilitate the control of treatment and other services.

6. CONCLUSIONS

This pollution survey failed to disclose any immediate problem areas in the township, although the Inverhuron area is rapidly approaching the need of communal services. Careful control of future development will minimize any long term problems in this regard. Similarly, development control is required along the northern shoreline where cottage development should only be allowed if the lots are large enough and the soil is proven to be conducive for the disposal of domestic wastes by the septic tank and tile field method.

The drilled wells in the area were found to yield a domestically safe water and their use in the future is encouraged in conjunction with communal distribution systems.

7. RECOMMENDATIONS

1. All future development should proceed on the basis of communal well supplies and where possible, integration of existing supplies should be carried out. The municipality should, in an orderly fashion, assume the ownership of all existing private communal supplies.

2. The use of septic tank and tile field systems, particularly in the Inverhuron area, should be reviewed and consideration should be given to the installation of a communal sewerage system.

3. Except in the Inverhuron area, the use of septic tank and tile field disposal systems can be continued in the township provided proper lot size, on which it is shown that these systems can be installed, and limited density of development is adhered to.

4. All existing water supplies and sewage disposal systems should be inspected and revamped, where necessary, to alleviate the existing pollution problems.

5. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 10

TOWNSHIP OF LINDSAY

	<u>PAGE</u>
1. GENERAL	111
2. FIELD SURVEYS	112
3. WATER SUPPLY	112
4. WASTEWATER DISPOSAL	115
5. DISCUSSION	115
6. CONCLUSION	118
7. RECOMMENDATIONS	119

TOWNSHIP OF LINDSAY

1. GENERAL

The Township of Lindsay is located in Bruce County, bounded on the west by the waters of Lake Huron, on the north by the Township of St. Edmunds, on the east by the waters of Georgian Bay, and on the south by the Township of Eastnor. The township incorporates a total land area of 105.45 square miles of very variable landscape of which less than 50 per cent is occupied farm land.

The overburden of this township is a member of the Breypen series. This series is most noted for its lack of any particular soil type since the terrain consists mainly of rocky outcrops intermingled with pockets of muck or soil of variable composition. As previously mentioned, this soil type is best suited for forest development although some mixed farming is conducted in more fertile areas.

According to the 1968 census, the permanent resident population of Lindsay Township is listed as 302. Seasonal fluctuations of several hundred per cent occur in this figure with the movement of tourists and cottage owners into the area.

On an economic basis, the permanent residents rely, for the most part, on the farming existing in the area. The tourist business and its related retail services contribute somewhat to the township

economy. There are only four sizeable communities in the township, these being Dyer Bay, Miller Lake, Brinkman Cors., and Cape Chin.

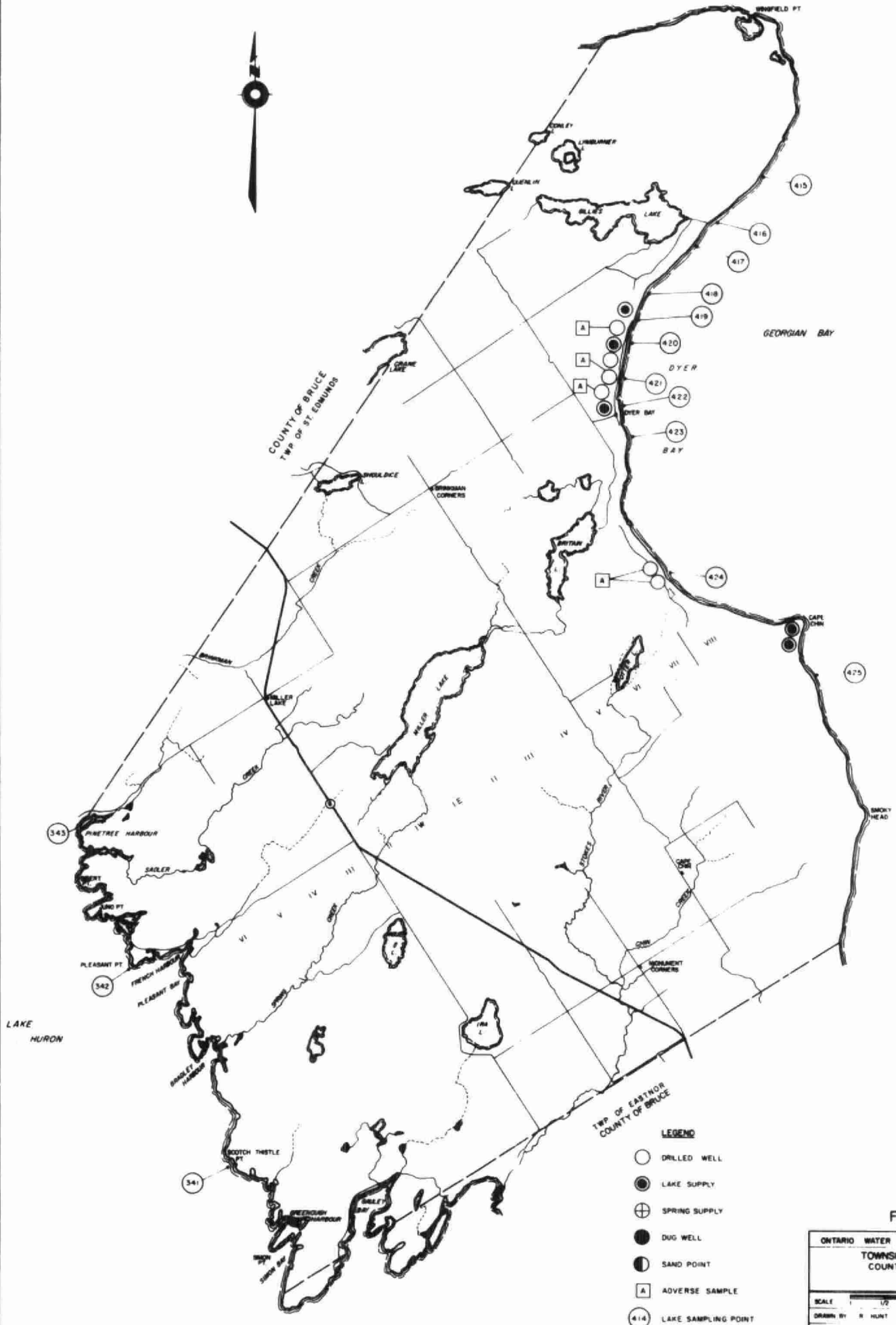
2. FIELD SURVEYS

The field work involved with the shoreline pollution survey in the Township of Lindsay was carried out on three different days. The initial survey, conducted on August 5, 1969 consisted of a door-to-door sampling of private drinking water supplies. On August 15 and 19, 1969, a shoreline survey was made of the waters of Lake Huron and Georgian Bay. The August 15 survey was carried out along the western shores of the township and on August 19, a survey of the eastern shores was carried out.

All bacteriological and chemical results obtained were analyzed and the results are presented in Appendix 16 and 17 respectively. The approximate locations of the sampling stations are presented in Figure 28. The adverse domestic supplies are also depicted on this map.

3. WATER SUPPLY

Drilled wells are the most predominant of the wells being used in the township. Their depth ranges from 40 to 80 feet, the average depth being roughly 50 feet. Although some cottage owners have drilled wells on their properties, the majority of the drilled wells



LEGEND

- DRILLED WELL
- LAKE SUPPLY
- ⊕ SPRING SUPPLY
- DUG WELL
- SAND POINT
- ⊠ ADVERSE SAMPLE
- LAKE SAMPLING POINT

FIG. 28

ONTARIO WATER RESOURCES COMMISSION	
TOWNSHIP OF LINDSAY COUNTY OF BRUCE	
SCALE 1" = 1/2 MI	DATE AUG. 1969
DRAWN BY R. HUNT	CHECKED BY
DWG. NO. 69-23-1	

the area are used by the permanent population.

A large percentage of the summer residents use Lake Huron or Georgian Bay as their source of domestic water. Most cottagers draw water directly from the lake without treatment by chlorination or filtering.

Owing to the small number of permanent residents, there are no communal water systems in operation in the township.

The well supplies in the area appear to be the favoured supply, although the greatest portion of those sampled during the survey were found to be contaminated. The reason for this contamination, as explained in the Summary (page 11) is due to the limestone bedrock and the very shallow soil covering. Surface runoff and domestic wastewater finds its way directly into the aquifer through fissures, solution passages, etc. and the result is a contamination of the entire groundwater table.

The lake supplies, as indicated in Figure 29, made up almost

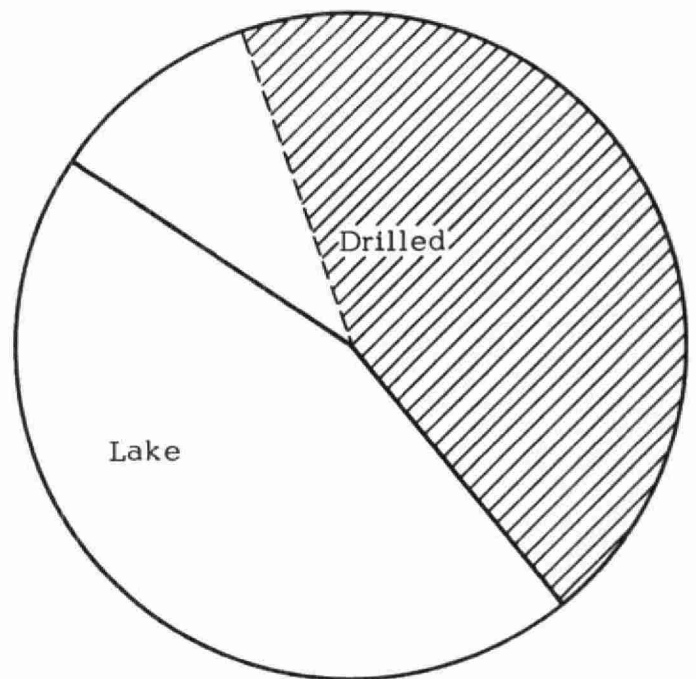


FIGURE 29 - TOWNSHIP OF KINCARDINE
- distribution of water supplies -
/// indicates per cent adverse

half the supplies tested and none of these were found to contain coliform bacteria. This would indicate that pollution of the aquifer is, in fact, caused locally and that this source is the preferred supply for any future communal water system in Dyer Bay.

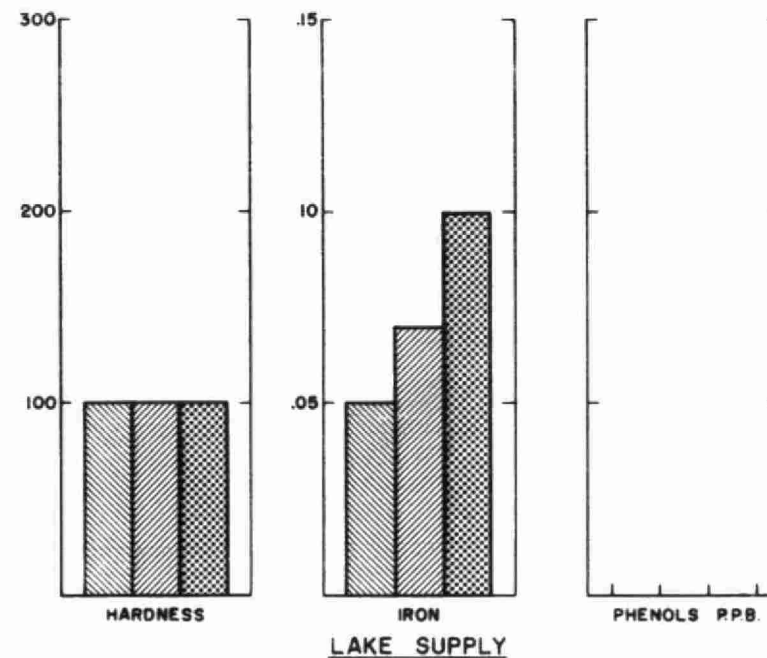
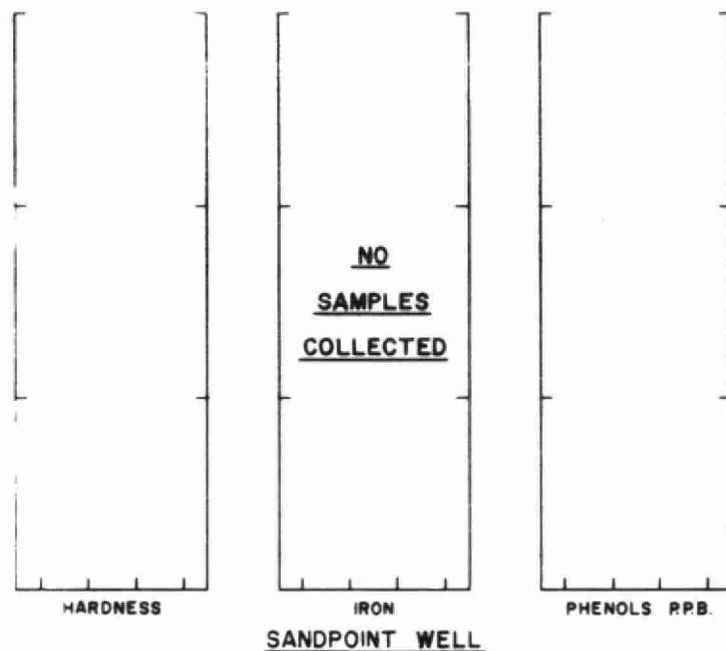
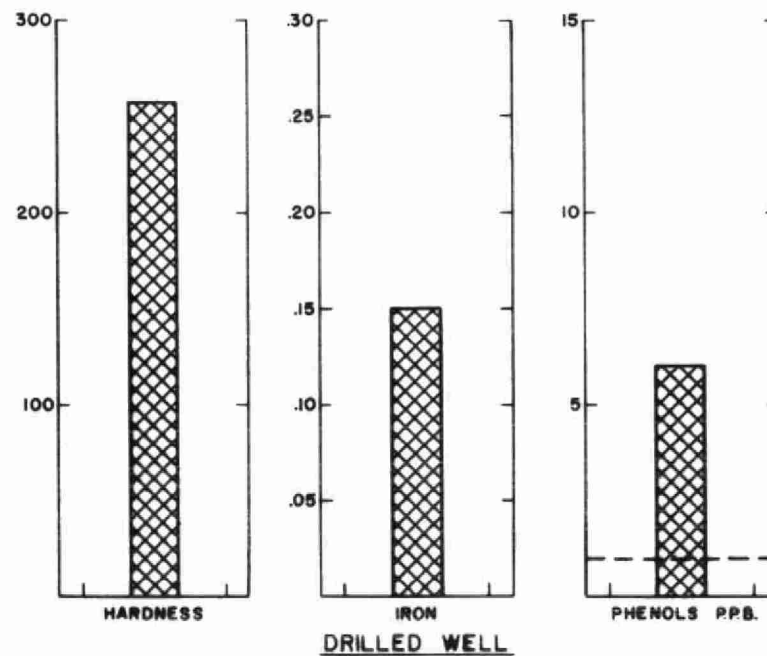
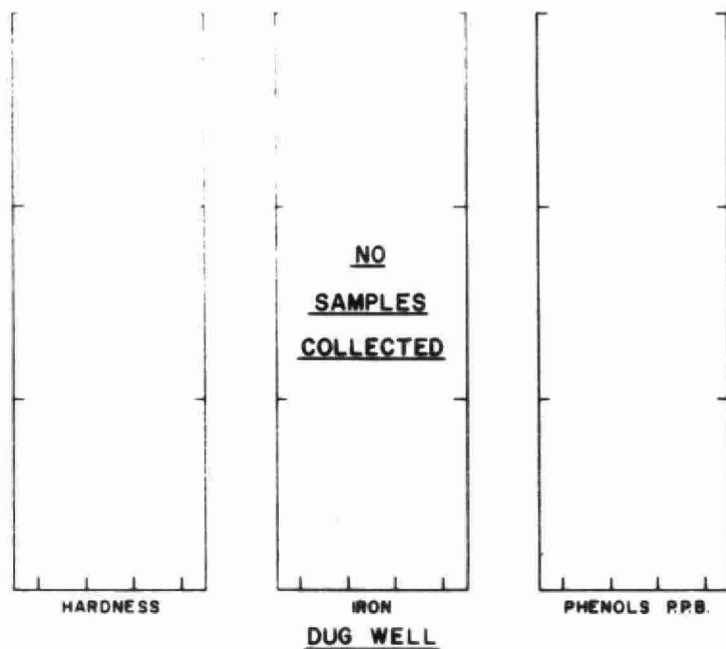
The chemical quality of the two major water supplies is summarized in Figure 30. Both sources are below the OWRC objective of 0.3 ppm for iron and the well water is hard.

4. WASTEWATER DISPOSAL

There are no community sewage works in the township. Sewage disposal is achieved through septic tank disposal systems which account for over 90 per cent of all sewage treatment facilities. All the cottages on the eastern shores use septic tank systems for sewage disposal. A few privies are still in use in certain areas of the township. The use of septic tank and tile field disposal systems should be discouraged in this township due to the unsuitable soil conditions. Installation of these facilities should also be disallowed on fill type disposal beds.

5. DISCUSSION

During the door-to-door survey, a total of 11 drinking water samples were obtained of which 45.5 per cent were found to be unsatisfactory for human consumption. High coliform bacteria counts in the neighborhood of 80+ per 100 ml.



--- OWRC RECOMMENDED LIMIT --- IRON = .30, PHENOL = 1.0

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED



MINIMUM VALUE



AVERAGE VALUE



MAXIMUM VALUE



SINGLE SAMPLE

FIG. 30 LINDSAY TOWNSHIP

of sample were obtained from the five adverse samples. Faecal coliform counts, some reaching as high as 80+ per 100 ml. of sample, were found in four of the adverse samples. Faecal coliform organisms are normally inhabitants of the human intestinal tract and are associated with the faecal discharges of warm-blooded animals. Their presence in a drinking water supply indicates that sewage wastes are gaining access to the supply and consequently, pose a define health hazard for those using them. In late August, a letter warning of the adverse results of their water supplies, was sent out to all cottagers concerned. The bad supplies were all found to be drilled wells tested during the survey.

A total of 14 samples were obtained of the lake water at a distance of roughly 200 feet offshore. Of this total, 50 per cent were found to exhibit low coliform counts in the neighborhood of 50 per 100 ml. of sample. These results should be compared to 2,400 organisms/100 ml. which is considered satisfactory for a lake and show that at the present time, the shoreline waters are in excellent condition.

Pollution of the wells in the area can be attributed, perhaps, to two probable causes. The first suspected cause would be that sewage wastes are escaping from malfunctioning or improperly constructed septic tank disposal systems. Soil conditions in the township are not conducive to this particular disposal facility as a good soil layer

is imperative for proper functioning. The second cause may be due to improperly installed seals when the wells were drilled. These seals may have developed leaks thus allowing surface runoff to enter the well and polluting the aquifer. All septic tank disposal systems and well supplies should be examined for malfunctioning and revamped where required.

6. CONCLUSIONS

From the results of samples taken during the shoreline survey, it can be said that, at the present time, the lake water is in good condition. This result can be attributed to the fact that cottage development in the township is not very intense, in fact, there are less than 20 cottages on the township's eastern shores. Future development in the township should be discouraged unless adequate communal domestic services are installed.

The drilled wells in the area are, for the most part, polluted to an extent that they pose a health hazard to persons using these supplies. The most likely causes of this condition are malfunctioning or improperly constructed septic tank disposal systems or well supplies. Due to the small development in Dyer Bay, a communal system, although preferred, would not be recommended due to the excessive costs. Every property owner in the area should be willing to accept the responsibility

for his own waste and water treatment practices.

Proper construction techniques are presented in the general discussion and the Bruce County Health Unit should be consulted for guidance in disinfecting individual wells and water supplies.

7. RECOMMENDATIONS

1. The Dyer Bay area should be provided with a municipally owned communal surface water supply system.
2. All existing water supplies and sewage disposal systems should be inspected and revamped, where necessary, to alleviate the existing pollution problems.
3. Future development on any scale should be permitted in the township except in areas where satisfactory wells and septic tank systems can be shown to be workable.
4. Filled lots should not be considered suitable for the installation of a septic tank and tile field disposal system.
5. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 11

TOWNSHIP OF SAUGEEN

	<u>PAGE</u>
1. GENERAL	121
2. FIELD SURVEYS	122
3. WATER SUPPLY	123
4. WASTEWATER DISPOSAL	128
5. DISCUSSION	128
6. CONCLUSION	130
7. RECOMMENDATIONS	131

TOWNSHIP OF SAUGEEN

1. GENERAL

The Township of Saugeen is located in the center of Bruce County bounded on the north by the Township of Amabel, on the east by the Townships of Arran and Elderslie, on the south by the Township of Bruce, and on the west by the waters of Lake Huron. The township encompasses a total area of 64.44 square miles of which over 90 per cent represents occupied farm land.

Soil conditions in this region are very variable particularly in the inland areas. The shoreline areas, of which we are mostly concerned, are predominantly covered with well-sorted outwash material notably of the sandy variety. Two soil series define the major portion of the Saugeen shoreline. The Plainfield and Brady series are the abundant overburden of the coast; the former exhibiting excessive natural drainage while the latter exhibits imperfect natural drainage. A small section of white beach sand of the Eastport series is found in the vicinity of the Town of Port Elgin. This area is very similar to Sauble Beach in the Township of Amabel.

As of the 1968 census, the population of the township was listed as 903 permanent residents. This figure does not include the populace inhabiting the towns of Port Elgin and Southampton. The 1968 population

figures for these towns were 2,055 and 1,738 persons respectively. Summer population figures vary but increases of several hundred per cent are experienced due to the influx of tourists and cottagers.

With over 90 per cent of the township comprised of farm land it is only natural that a large portion of the local economy is based on the farming industry. Farming in the area is mainly of the mixed variety although dairy farming is a major industry in the Town of Port Elgin. The furniture or wood industry forms the basis of the local economy in the Town of Southampton. As would be expected the township economy is stabilized by the tourist industry and its related retail services. Large cottage developments are located in the vicinity of the towns of Port Elgin and Southampton as well as the area in and about Miramichi Bay although this is not a congested cottage area at the present time.

2. FIELD SURVEYS

The initial sanitary survey was conducted during the period July 28 to July 30, 1969. This survey consisted of door-to-door sampling of private drinking water supplies of residences along the shoreline. A total of 29 drinking water samples were obtained at that time.

During the period of August 11 to August 12, 1969, a coastline

survey of the Lake Huron shoreline was carried out. A total of 17 lake water samples were obtained at an average of 1,000 feet offshore.

The approximate sampling locations of both surveys, along with the areas exhibiting adverse samples, are presented in Figure 31. All bacteriological and chemical analytical results may be found in Appendix 18 and 19 respectively.

3. WATER SUPPLY

Sandpoint supplies serve over 70 per cent of the residences in the township. The minimum quantity of water available in some of the sandpoints forms the major complaint received in regard to these supplies. In the area between the north shore and Port Elgin, the largest complaint regarding the sandpoint wells is the sulphur taste which is very objectionable in a drinking water supply.

Drilled wells are the second major drinking water supply in the township. These wells serve roughly 15 per cent of the residences. The drilled depth of the wells ranges from 50 to 100 feet. High iron content in this water is a prime complaint heard from those persons using drilled well supplies.

Dug wells in the area are used by approximately 10 per cent of the residents while other sources, mainly springs, serve the remaining 5 per cent.

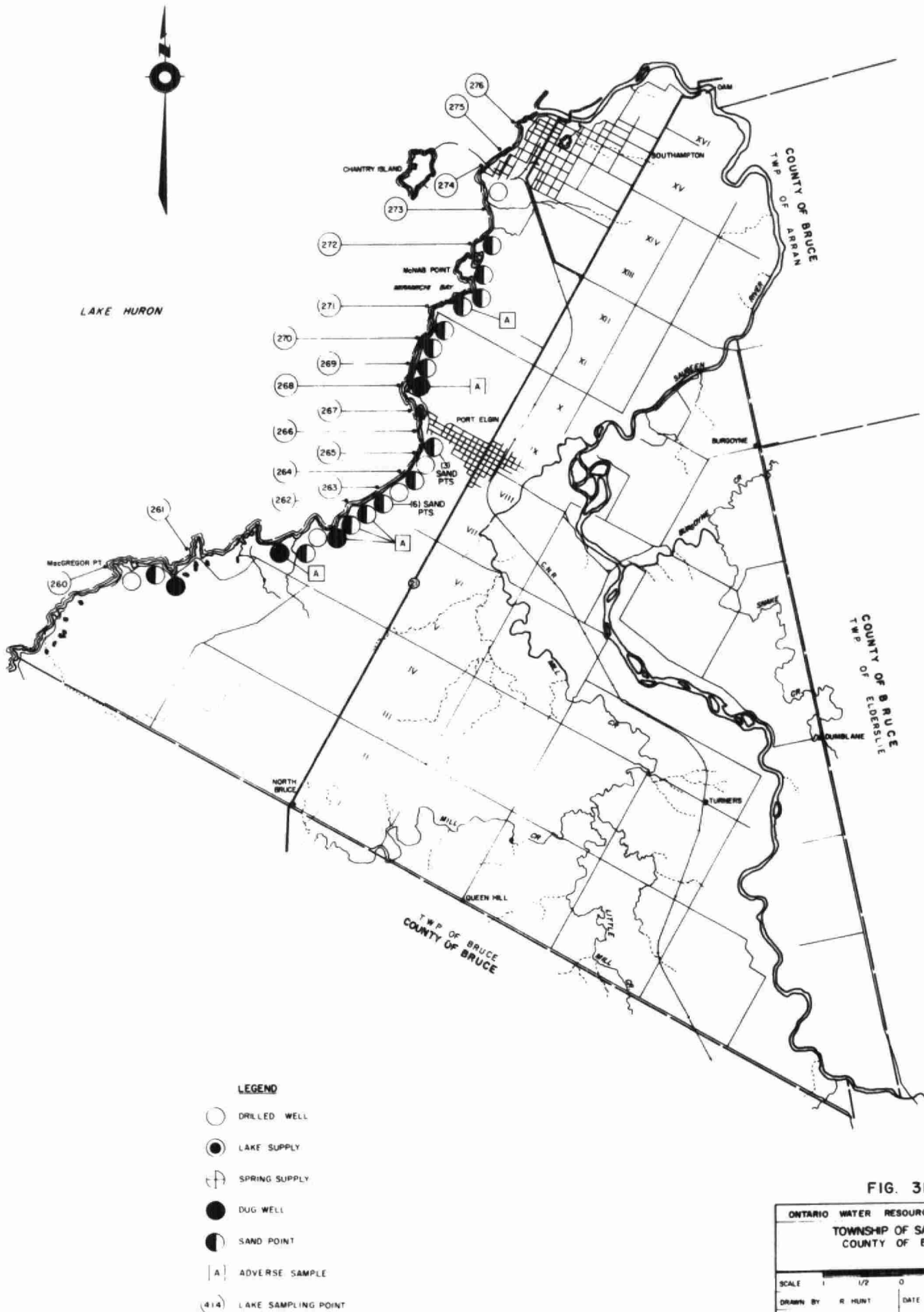


FIG. 31

ONTARIO WATER RESOURCES COMMISSION
TOWNSHIP OF SAUGEEN
COUNTY OF BRUCE

SCALE	1/2	0	1 MI
DRAWN BY	R. HUNT	DATE	SEPTEMBER, 1969
CHECKED BY		DWG No	69-136 DE

There were no lake supplies located during the survey. The distribution of private water sources as well as the percentage of adverse samples obtained at each location is summarized in Figure 32. In addition to these supplies, a few of the cottage owners in the vicinity of Port Elgin and Southampton utilize the municipal water supply system.

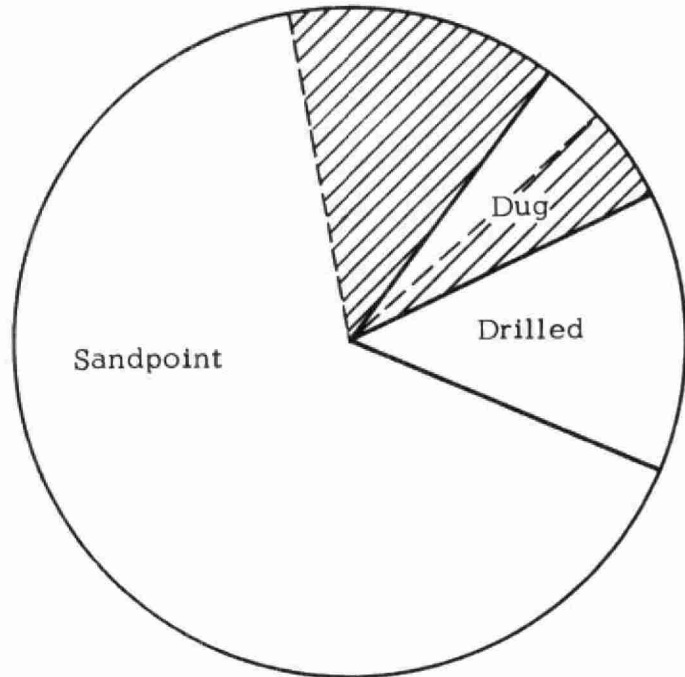


FIGURE 32 - TOWNSHIP OF SAUGEEN
- distribution of shoreline water supplies
/// indicate per cent adverse

Communal, private water supply systems are not common within the township and our records indicate that only one such system is inspected annually by this Commission. The details of that supply are summarized in Table 9 below:

TABLE 9
FAIRWAY PARK WATER WORKS

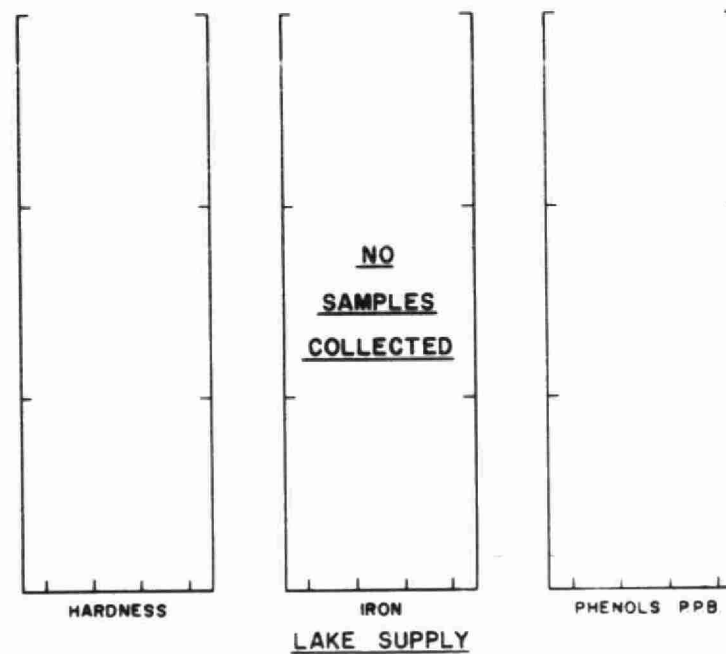
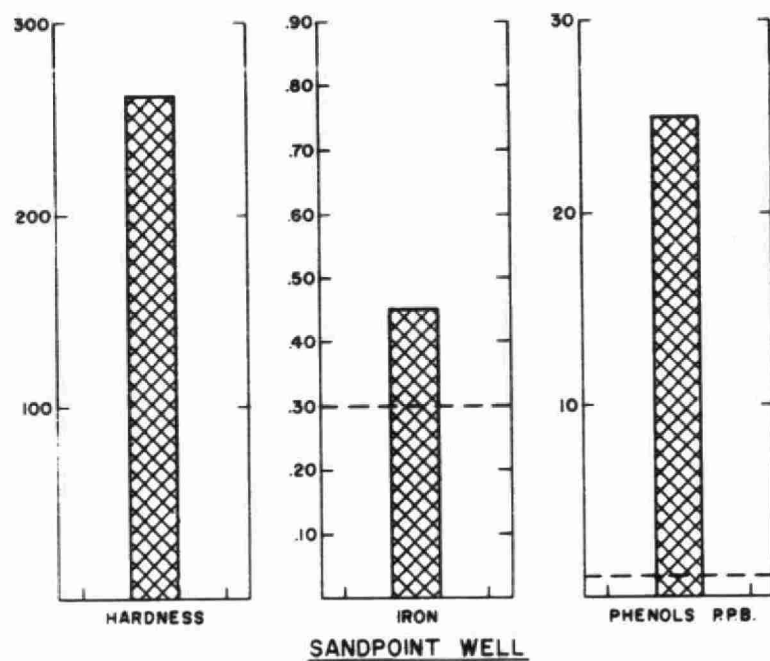
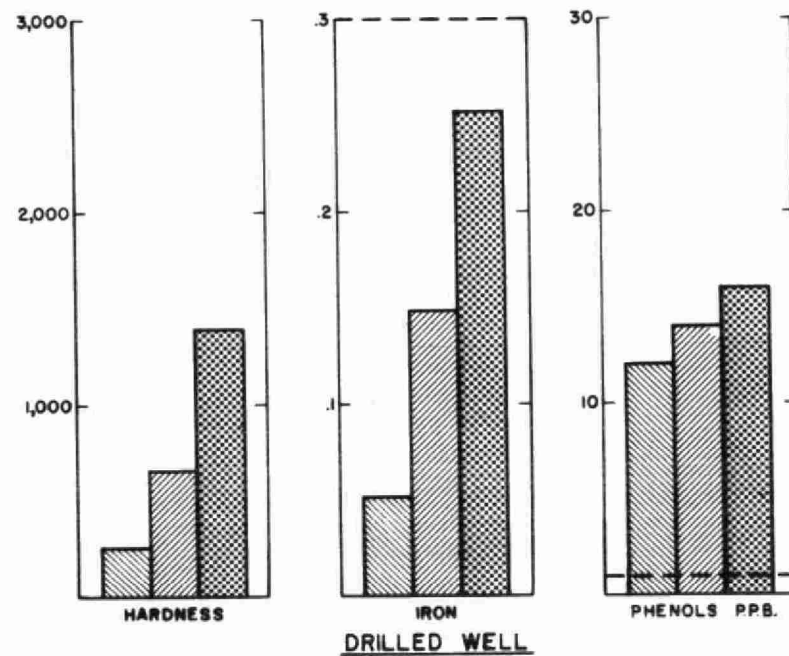
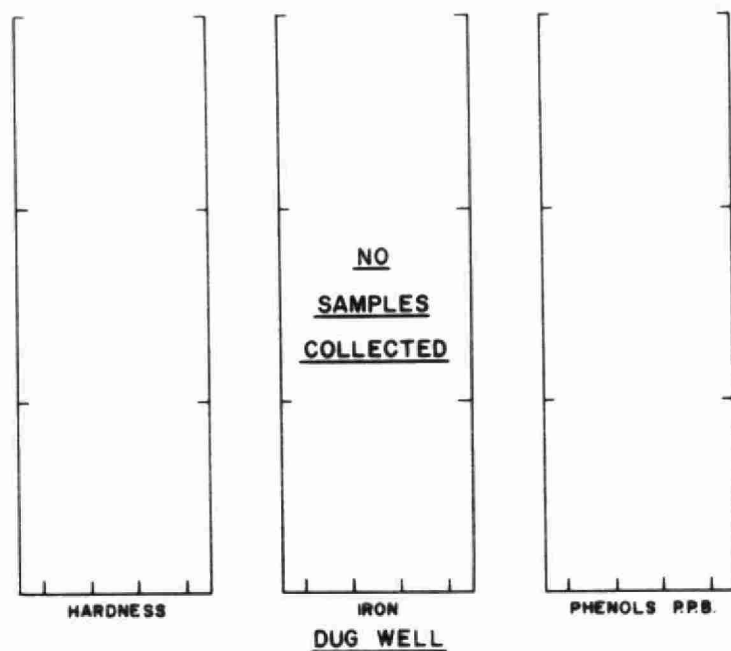
OPERATOR	SOURCE	NO. OF CONNECTIONS	CAPACITY	TREATMENT	QUALITY
MR. E. PUTNAM PORT ELGIN	DRILLED WELL (63')	150 (APPROX.)	N.A.	NONE	SATISFACTORY*

* BASED ON 1969 ANALYTICAL RESULTS

The results of the bacteriological analyses obtained indicate that the preferred individual water supply in the township is the sandpoint even though in some areas this supply was found to contain excessive concentrations of iron. This type of a supply is ideal for individual cottages since it yields a bacteriologically safe water quality in most cases, and is relatively inexpensive to install. The only drawback with such a supply is the restriction placed on the capacity.

The dug wells in the township appeared to be most adversely affected by ground and wastewater pollution. This could be due to improper construction of the well or a malfunctioning sanitary seal. The presence of faecal coliforms in these supplies indicates that wastes from warm-blooded animals, probably man, is gaining access to the water table.

The chemical quality of an average sandpoint supply and several drilled well supplies is presented in Figure 33. The well water is extremely hard and both sources contain excessive amounts of phenols.



----- OWRC RECOMMENDED LIMIT ----- IRON = 30, PHENOL = 1.0

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED



FIG. 33 SAUGREEN TOWNSHIP

4. WASTEWATER DISPOSAL

Sewage disposal in the township is achieved through septic tank and tile bed systems by 95 per cent of the residences. Of these systems, only 10 per cent have separate connection for the sink and laundry wastes. The remaining 5 per cent of the sewage treatment facilities used in the township consists of the outdoor pit privys.

The presence of faecal coliform organisms in the majority of the dug wells tested during this survey indicates that malfunctioning sewage treatment units may exist along the shoreline. All such systems should be examined for possible malfunctioning.

5. DISCUSSION

By far the largest drinking water supply tested was the sand-point well. A total of 21 of these wells were sampled, the results showing that only 4 of the 21 or 19 per cent were found to be adverse. The coliform bacteria counts exhibited by these adverse samples were only 2 per 100 ml. of sample which shows that the level of pollution in the source is very low.

However, the sampling results for the dug wells tested showed that these sources are very poor by virtue of the fact that 3 of the 4 wells tested were found to be unsafe for human consumption. High coliform counts in the vicinity of 56 per 100 ml. of sample and corresponding

faecal coliform bacteria counts of 46 per 100 ml. of sample revealed that these supplies are polluted to a much greater degree than were the sandpoints. The fact that faecal organisms are present in these supplies shows that domestic sewage is gaining access to the wells most likely from malfunctioning septic tanks.

The third water supply sampled were the drilled wells of which only 5 were tested. However, none of these supplies were found to be bacteriologically adverse, although the high iron content of the water caused some taste complaints.

Results of the lake water survey showed that 94.1 per cent of the samples revealed coliform organism counts reaching as high as 128 per 100 ml. of sample and related faecal coliform counts as high as 48 per 100 ml. of sample. The presence of faecal coliform organisms indicates that the lakewater quality immediately adjacent to the township has been greatly affected by malfunctioning septic tank systems in the vicinity.

The effects of urbanization are dramatically illustrated by the widely distributed presence of faecal coliform organisms along the shoreline in the vicinity of Port Elgin and Southampton. The Lake Huron water along the Saugeen Township shoreline showed the greatest impairment of the entire Bruce County shoreline. Some of the highest faecal coliform organism counts were obtained in the vicinity of these

two urban areas and their source was directly contributed to the domestic sewage disposal practices along the shoreline. The water quality in this area should increase in the near future because the two major municipalities are presently in the progress of installing new sewage treatment facilities.

6. CONCLUSIONS

Generally speaking, there is no evidence at present of serious water supply problems in the township. On an individual name basis, sandpoint supplies appear to be preferred due to the low price of construction and the good water quality. The use of dug wells or lake supplies on a similar basis is not recommended due to the degree of treatment which would be necessitated in each case. If communal systems are installed in the future, lake water or drilled wells would have to be utilized to supply the required volumes.

Domestic waste disposal practices in the township appear, generally, to be satisfactory. However, the presence of faecal coliform organisms in several supplies, including Lake Huron, indicate that wastes from warm-blooded animals probably man, are gaining access to these water bodies. All individual sewage disposal systems should be examined for faulty operation and repaired, if required.

All future cottage and subdivision development in the township should be in accordance to the official plan. Use of the existing domestic facilities serving Port Elgin and Southampton is encouraged.

7. RECOMMENDATIONS

1. All existing water supplies and sewage disposal systems should be inspected and revamped, where necessary, to alleviate the existing pollution problems.

2. Any significant development in the township should be directed to those areas which can be reasonably serviced from the large urban area of Southampton and Port Elgin.

3. In the remaining sections, only large lots on which it is shown that individual wells and septic tank systems can be installed should be considered for development. Sandpoints as a water supply should be considered.

4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 12

TOWNSHIP OF ST. EDMUNDS

	<u>PAGE</u>
1. GENERAL	133
2. FIELD SURVEYS	134
3. WATER SUPPLY	134
4. WASTEWATER DISPOSAL	138
5. DISCUSSION	138
6. CONCLUSION	140
7. RECOMMENDATIONS	141

TOWNSHIP OF ST. EDMUNDS

1. GENERAL

The Township of St. Edmunds is located in Bruce County at its northern extremity, bounded on the north and west by the waters of Lake Huron, on the east by the waters of Georgian Bay and on the south by the Township of Lindsay. The township embodies an area of 106.48 square miles of rocky terrain of which roughly 9 per cent is occupied farm land.

The overburden of this area is of the Breypen series and as such does not consist of any particular soil type but is largely rock outcrops with small pockets of soil scattered throughout. Generally speaking, this land type is best suited for forest development although certain areas have been cleared and are producing reasonable grain crops.

According to the 1968 census, the permanent population of St. Edmunds Township is 467. This figure increases by 300-600 per cent with the seasonal influx of tourists into the area.

Economically speaking, the township's primary source of revenue is the tourist trade and related retail services. Some farming does exist in the interior of the township and is mainly of the mixed variety.

2. FIELD SURVEYS

The field work associated with the survey in the Township of St. Edmunds was carried out as a series of separate, smaller surveys. The first surveys conducted during the period July 29 - August 2, 1969, consisted of a representative door-to-door sampling of cottagers' drinking water supplies. The survey of August 13, 1969 was a shore-line survey carried out by the local Health Unit on the waters of Tobermory Harbour. A re-survey, following the original sampling path, was conducted on September 3 and 5 in an attempt to better evaluate the level of pollution in the harbour. Surveys conducted at the beginning and end of the tourist season help to better evaluate the pollution effects of the summer population.

The approximate sampling locations associated with the first survey are depicted in Figure 34. The analytical results of all bacteriological and chemical water samples obtained during this survey may be found in Appendix 20 and 21 respectively.

Specific details of the Health Unit surveys were utilized in preparing the water pollution survey of Tobermory (see Appendix 3).

3. WATER SUPPLY

Drilled wells are used by the majority of the permanent residents of the township although several dug wells are in operation in the area.

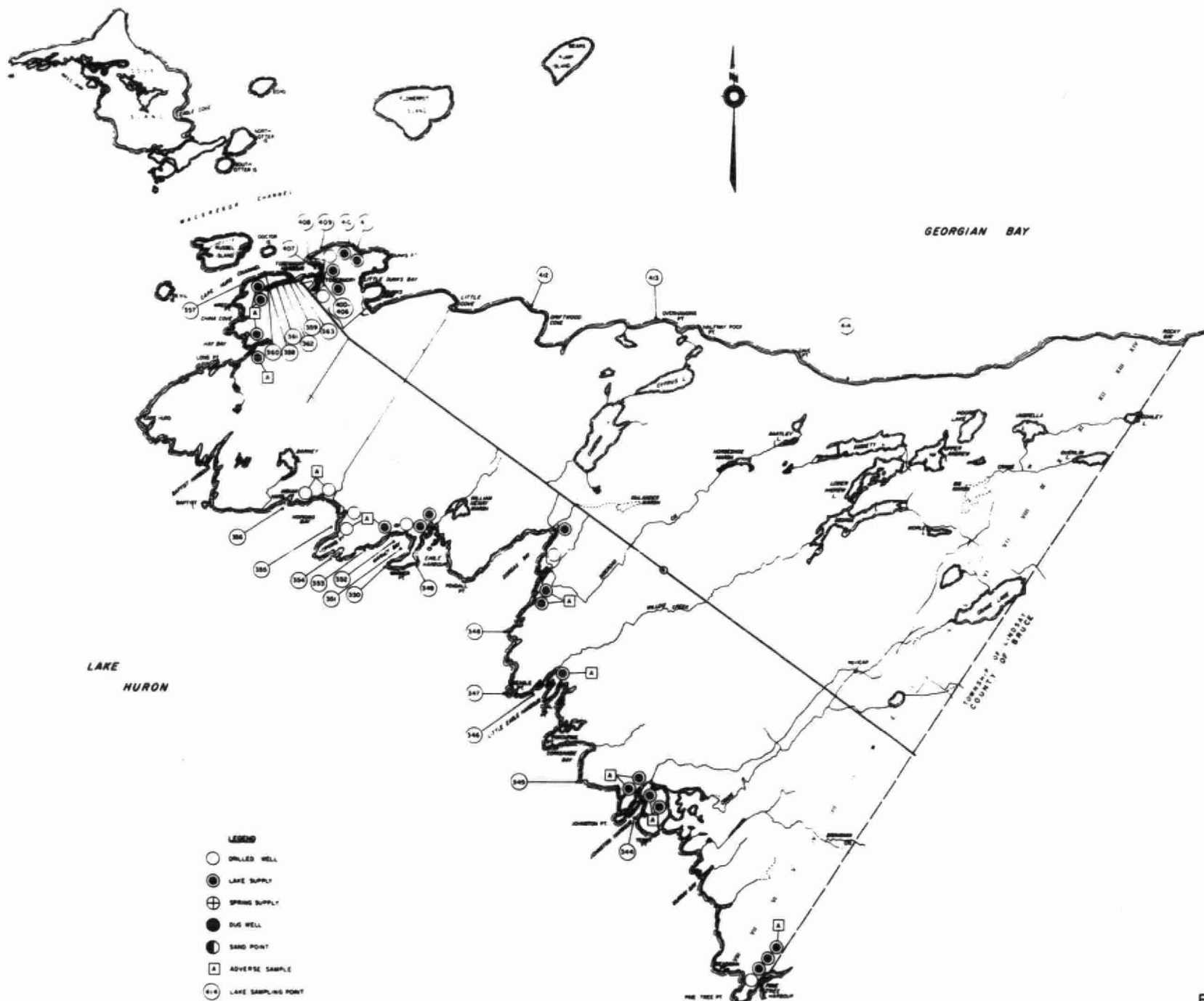
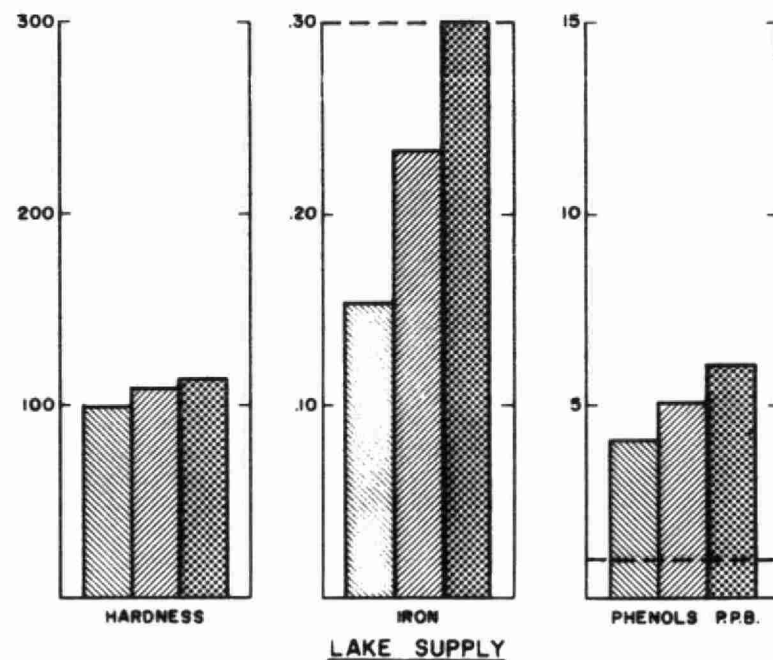
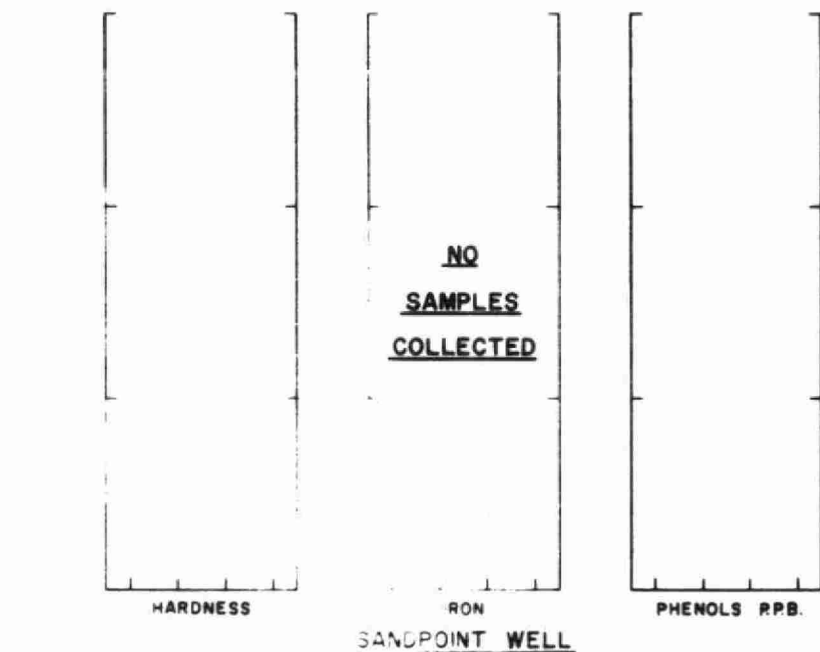
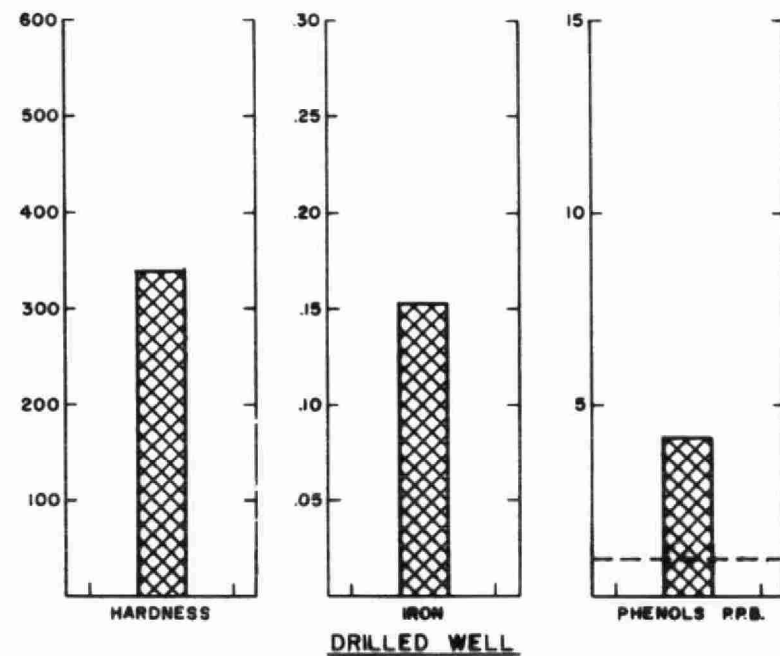
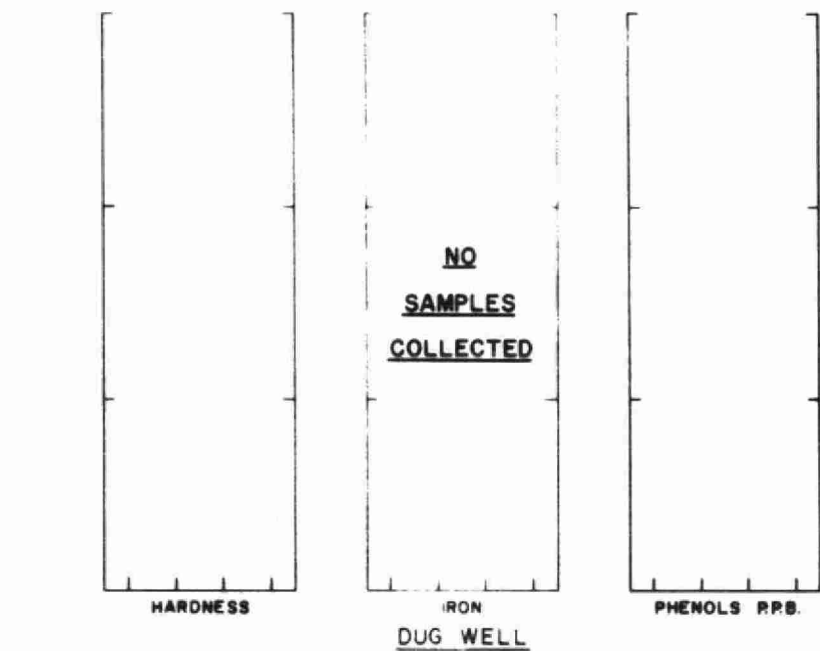


FIG. 34

ONTARIO WATER RESOURCES COMMISSION	
TOWNSHIP OF ST. EDWARDS	
COUNTY OF BRUCE	
SCALE	1:50,000
DRAWN BY	DATE
CHECKED BY	DATE



----- OWRC RECOMMENDED LIMIT ----- IRON = .30, PHENOL = 1.0

ALL VALUES REPORTED IN PPM UNLESS OTHERWISE INDICATED

MINIMUM VALUE

AVERAGE VALUE

MAXIMUM VALUE

SINGLE SAMPLE

FIG. 35 ST. EDMUNDS TOWNSHIP

The average depth of the drilled wells is roughly 60 feet but ranges from 47 to 150 feet. The most common complaint about the quality of this water is the iron taste present. The chemical quality of a representative drilled well and several lake samples is presented on Figure 35. The phenols were again excessive and taste problems could result when these supplies are disinfected using chlorine.

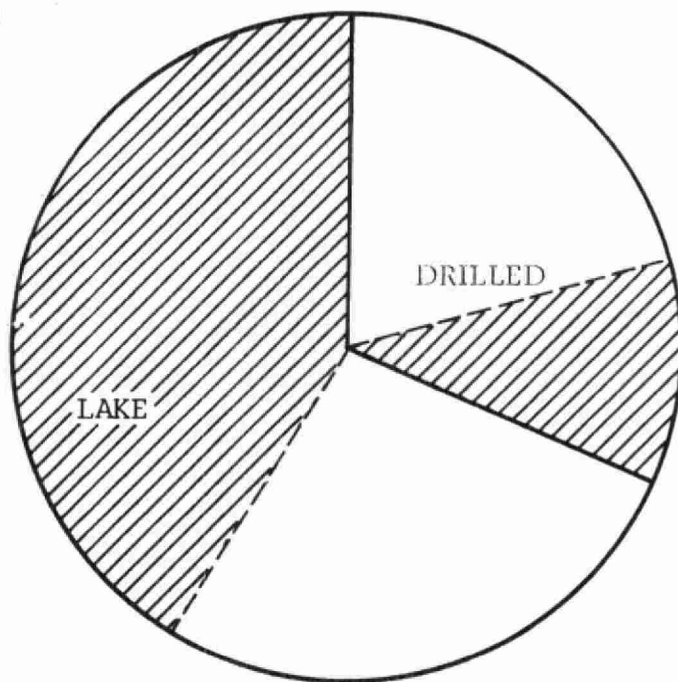


FIGURE 36 - ST. EDMUNDS TOWNSHIP
- distribution of shoreline water supplies
/// indicates per cent adverse

The waters of Lake Huron and Georgian Bay provide domestic water for the greater portion of the summer residents. The distribution of the various water supplies used and the per cent found to contain the presence of coliform bacteria is shown in Figure 36. Roughly 40 per cent of these supplies are treated either by chlorination or filtering. It should be noted that all surface water supplies should, in addition to filtration alone, be disinfected prior to consumption.

The greatest complaint about this water source is the odour associated with it. Odours are common in water supplies containing algae. The

chemical summary presented in Figure 35 also shows the presence of large quantities of phenols, which when combined with chlorine during the disinfection process, form chlorophenolic compounds that cause noticeable taste problems at concentrations as low as 0.001 ppm.

4. WASTEWATER DISPOSAL

There are no municipal or community sewage works of any kind in the township. Sewage disposal is achieved by septic tank disposal systems which account for roughly 90 per cent of all disposal systems used in the township. The other 10 per cent represents privies still in operation.

The overburden associated with St. Edmunds Township is undesirable for the disposal of waste by the methods presently employed and the use of filled tile beds should be discouraged as an interim solution.

5. DISCUSSION

A total of 24 samples of private drinking water supplies were obtained during the township survey. Of these 54.1 per cent were found to be unsafe for human consumption since coliform bacteria counts as high as 80+ per 100 ml. of sample were recorded. Of the 13 bad results, a total of 6 were found to contain faecal coliform organisms which indicate the presence of human excreta in the water supply. A letter was dispatched in late August to all cottagers whose water supply

was found to be unsatisfactory. The letter recommended that all water be boiled for a minimum of 10 minutes prior to consumption.

The pollution surveys conducted on Tobermory Harbour indicate that the waters of the harbour are polluted. Coliform counts reaching as high as 2.5 million per 100 ml. of sample are indicative of the severity of the problem. A total of 35 water samples were obtained in the survey of which 82.9 per cent had bad coliform counts. High faecal coliform counts were found in 40 per cent of the samples taken, (counts as high as 2,400 per 100 ml. of sample). The re-survey of the harbour showed little change although coliform counts had dropped considerably in certain locations.

The water supplies showing the poorest results, other than for the lake water, are the drilled well supplies. It is suspected that sewage wastes are entering the ground water from malfunctioning or improperly constructed septic tanks. The soil conditions of the area are inadequate for such a waste treatment facility. The lack of soil cover which acts as a filtering agent, causes liquid wastes to flow unheeded over the bedrock into drinking water supplies causing domestic pollution of these supplies.

The pollution of the harbour is due, in part, to these poorly operating septic tank systems. A greater problem in regard to the harbour pollution is the dumping of garbage and sewage wastes directly

into the water. The large number of pleasure craft in the area only serve to compound the problem. One pump-out station is provided in the harbour for public use. Stricter enforcement of the boating regulation forbidding the dumping of garbage and sewage wastes into natural waterways appears to be a necessity if the present problem is to be corrected.

6. CONCLUSIONS

A serious potential health hazard exists in the vicinity of the community of Tobermory. Most motels and other tourist resorts in this area draw their water from the harbour which contained excessive coliform organisms that may be very dangerous to human health. The minimum treatment required for domestic water taken from the harbour is filtration followed by chlorination. Presently, only chlorination or filtration is being practiced in most cases and this should be augmented by the lacking process.

As an interim solution, further building in Tobermory should be carried out on larger lots and domestic water obtained from Lake Huron should be treated and disinfected before use. The installation of tile fields should be discouraged in areas which necessitate the prior construction of a disposal field. The immediate problem facing Tobermory is the necessity of constructing communal water and sewage

treatment facilities. The cost of such a system will probably be excessive, so it is essential that proper planning be associated with its establishment.

Conditions about the township, although not as severe as in Tobermory, are still problem enough to warrant that serious consideration be given to the establishment of community sewage systems and treatment facilities as the ultimate solution to the present pollution problems. It is the responsibility of every cottager, every permanent resident, and all property owners to ensure that his own waste treatment facilities are operating in a satisfactory manner and not contributing to the pollution of the surrounding waters.

Future development of subdivisions and cottage communities should be discouraged in this township and an official plan with associated by-laws should be obtained to facilitate the recommendations of this report.

7. RECOMMENDATIONS

1. The Big Tub, Hopkins Bay, Warner Bay, and Dorcas Bay areas should be provided with communal surface water supply systems and the existing septic tanks and tile fields should be inspected and revamped, where necessary. Communal water and sewage systems should be installed in Tobermory.

2. No new development of any size should be permitted in the township. Only those lots which are large and on which wells and septic tank systems are shown to be workable should be considered for development. Filled lots should not be considered suitable for the installation of septic tank and tile field systems.

3. All existing water supplies and sewage disposal systems should be inspected and revamped, where necessary, to alleviate the existing pollution problems.

4. In order to properly control future development in the township in accordance with the servicing requirements, an official plan and associated by-laws should be developed as soon as possible.

CHAPTER 13

GENERAL DISCUSSION

	<u>PAGE</u>
1. WATER SUPPLY	144
1.1 Groundwater	144
1.2 Surface Water	152
2. WASTEWATER DISPOSAL	155
2.1 Private Systems	156
2.2 Municipal Systems	159

GENERAL DISCUSSION

1. WATER SUPPLY

1.1 Ground Water

(a) Occurrence and Availability

Ground water occurs in the zone of saturation below the surface of the ground. In this zone, all openings in the earth's formation are filled with water replenished by precipitation which infiltrates from the land surface. The upper level of the zone is called the water table, fluctuating annually in relation to the amount of precipitation that enters the ground. This phenomenon is termed "ground water recharge" and occurs naturally from precipitation. It has been estimated that approximately 10 per cent of the annual precipitation reaches the zone of saturation in this manner. An interesting fact is that the average annual recharge period extends from November to May since most of the rain that falls during the summer and fall months never reaches this zone because it is used up mostly as soil moisture.

Groundwater moves constantly under the influence of gravity with the rate of movement dependent on the permeability of the earth formation. Permeability determines how a formation will act as a source of water, i.e. transmit water. A formation such as sand and gravel or creviced limestone which has many pore spaces that are

sufficiently large and interconnected to allow groundwater to move freely through them is called an aquifer. If an aquifer is tapped by a well or other hole, the water will rise into the hole to some point known as the piezometric level (called static level by well drillers and operators). If a movement of water exists through the aquifer, the piezometric levels will lower in the direction of the flow. The slope of these levels is the hydraulic gradient of the confined water.

Figure 3 (in map pocket) indicates the hydraulic gradient of the aquifer. It can be seen that the groundwater in the Bruce County flows from east to west. Because the aquifer is generally limestone in the northern area, pollution passages probably exist that allow the passage of large volumes of water. The ground water is stored in the pore spaces between the sand and clay particles and in the crevices and solution channels of the rock formations. The general range in porosity of natural sediments and sedimentary rock is given in Table 10.

TABLE 10
POROSITY OF NATURAL SEDIMENTS

MATERIALS	POROSITY PER CENT
SANDSTONE	4-30
SAND, CLEAN AND UNIFORM	30-40+
GRAVEL, CLEAN AND UNIFORM	30-40+
SAND AND GRAVEL MIXED	15-25
SILT AND CLAY (AS DEPOSITED	40-60
AS DEPOSITED	40-90
COMPACTED AND DEWATERED	20-40
SHALE	1-35
LIMESTONE	1-50

The filtering capacity of this type of aquifer is very limited and may result in the build-up of contaminants from malfunctioning sewage disposal systems and wells as the groundwater flows from the eastern to the western shoreline. The bacteriological results indicate that contamination of the aquifer is generally higher in the downstream areas. This effect is not noticed in the southern area (recall the division of the county as previously indicated in Figure 1).

In Bruce County, the water-bearing properties of the overburden are generally poor particularly in the townships south of the Township of Albermarle. A number of complaints concerning limited quantities of water in dug wells were received from cottagers in these southern townships. Sand and gravel formations, near the surface and at depth, are good sources of water but these are usually very limited in area.

Sandpoints in the Sauble Beach area supply small quantities of water of good quality although the amount is not usually sufficient to meet a heavy demand. The bedrock generally supplies an adequate quantity of water, although its quality is usually inferior.

(b) Quality

By far the largest complaint registered against the quality of ground water supplies is the excessive mineral content. Due to the nature of the bedrock, limestone and dolomite predominating, the

groundwater is extremely hard particularly in drilled wells which extend to or below the bedrock surface. Dug wells also produce water of high hardness.

Most drilled supplies were high in sulphates, particularly in the Townships of Eastnor, Albemarle, Amabel and Saugeen. This compound imparts a very objectionable taste and odour to the water. Many sandpoints in Amabel and Saugeen townships also yield water exhibiting sulfur taste and odour problems.

Iron content levels are frequently in excess of the recommended upper limit of 0.3 ppm. Iron content higher than this limit may result in very objectionable colour, odour, and taste problems. In addition, higher iron content can cause staining or discolouration of water fixtures and deposition of iron (in a solid form) on water pipes.

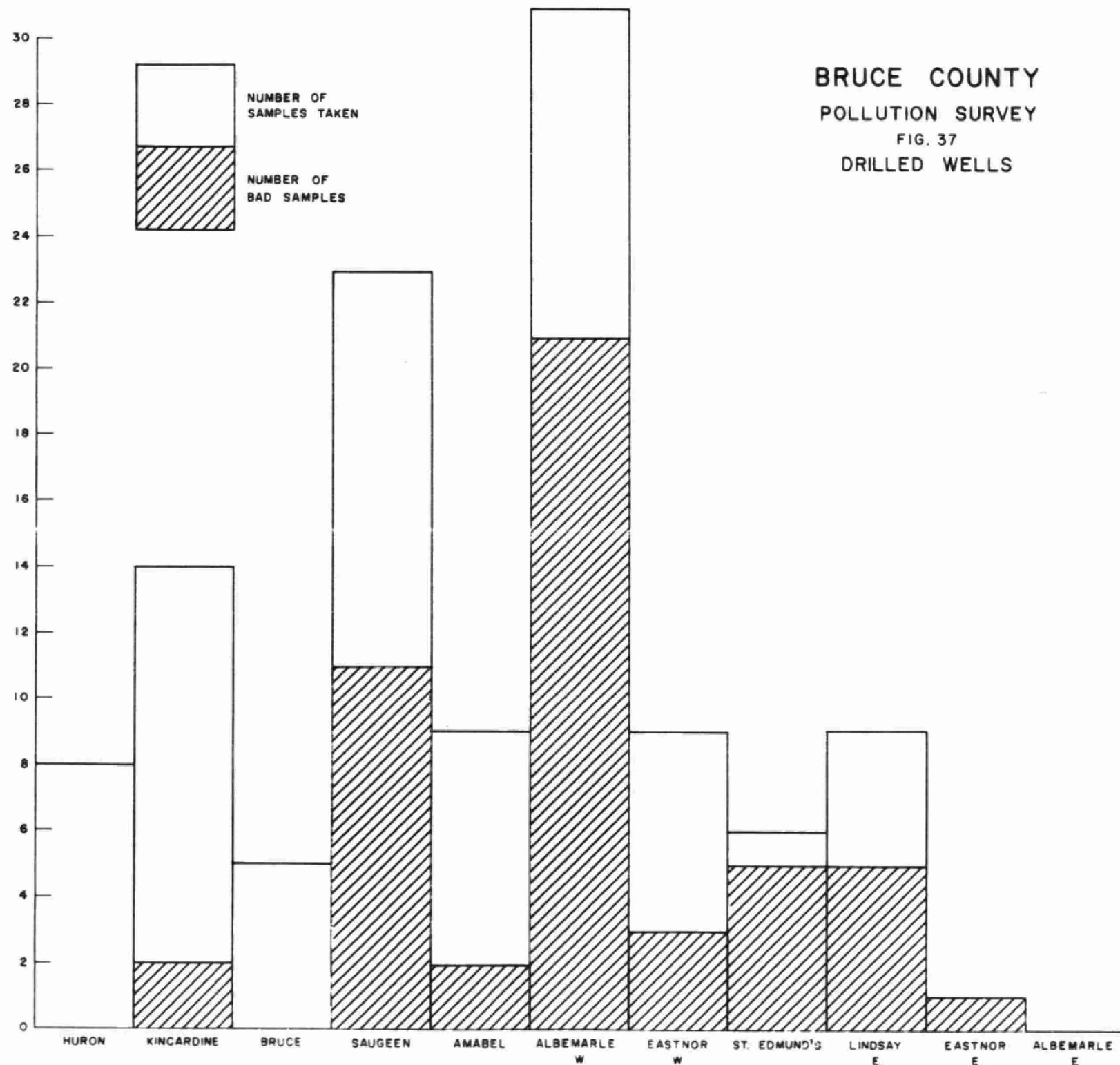
It is interesting to notice that all water sources examined contained a relatively uniform quantity of phenols. Phenol concentrations in excess of the 1.0 ppb OWRC objective were obtained in every case and values as high as 50 to 120 ppb were discovered in some drilled wells. The source of these hydrocarbons was not investigated during this survey; however, it is felt that fracture seepage of phenols from local pockets of gas is occurring. The bedrock, which is part of the escarpment that runs from the Manitoulin Island to Niagara Falls, is a producible hydrocarbon formation and has

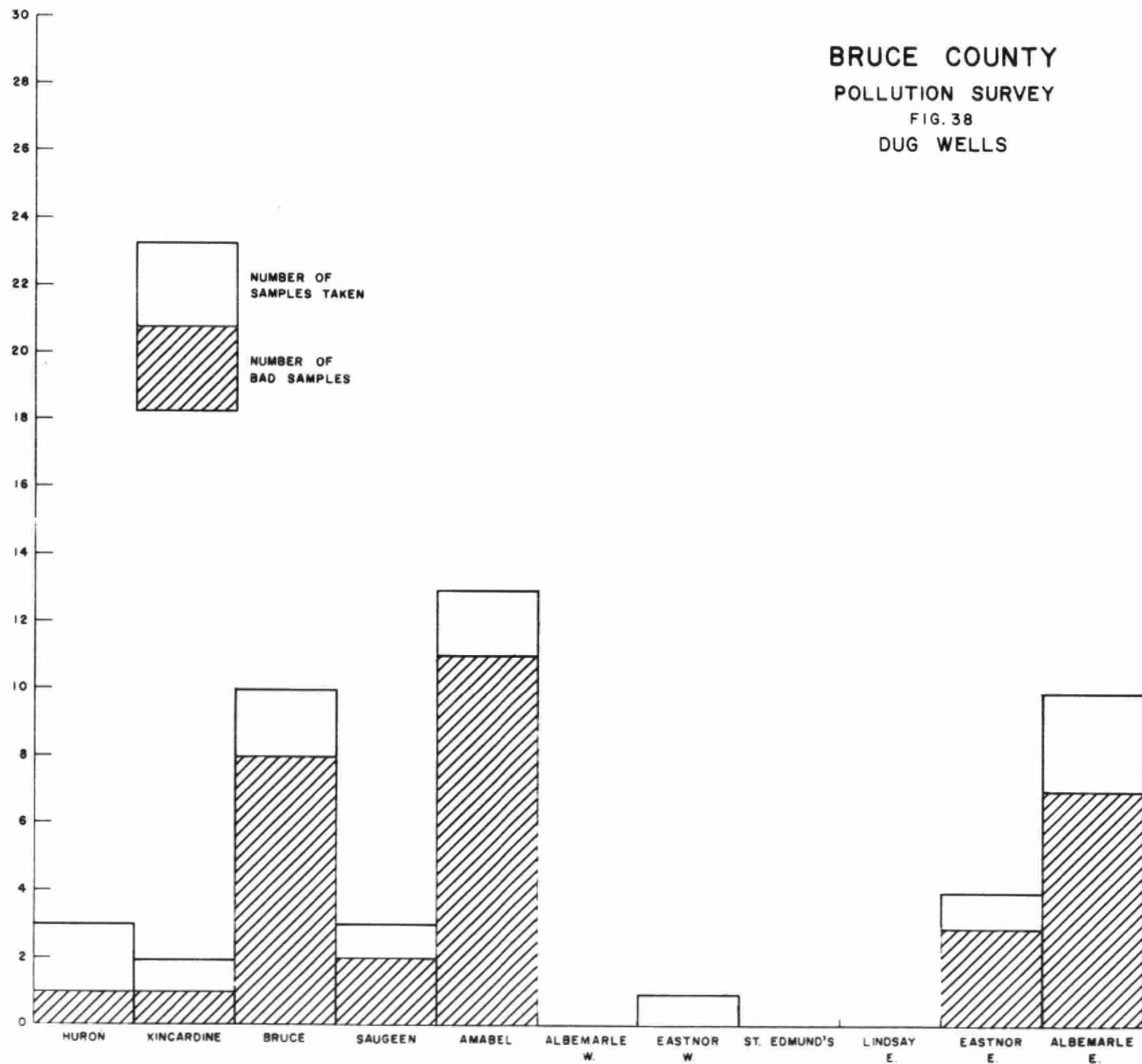
many wells in operation near the southern portion. Several years ago, one of the major American Oil Companies also had several active wells operative in the Manitoulin area but these are no longer productive. In areas such as this, it is not uncommon to experience phenol migration from confined pockets of natural gas, via fractures, into the surrounding groundwater. The result is minor pollution of ground and surface water in localized areas such as Bruce County.

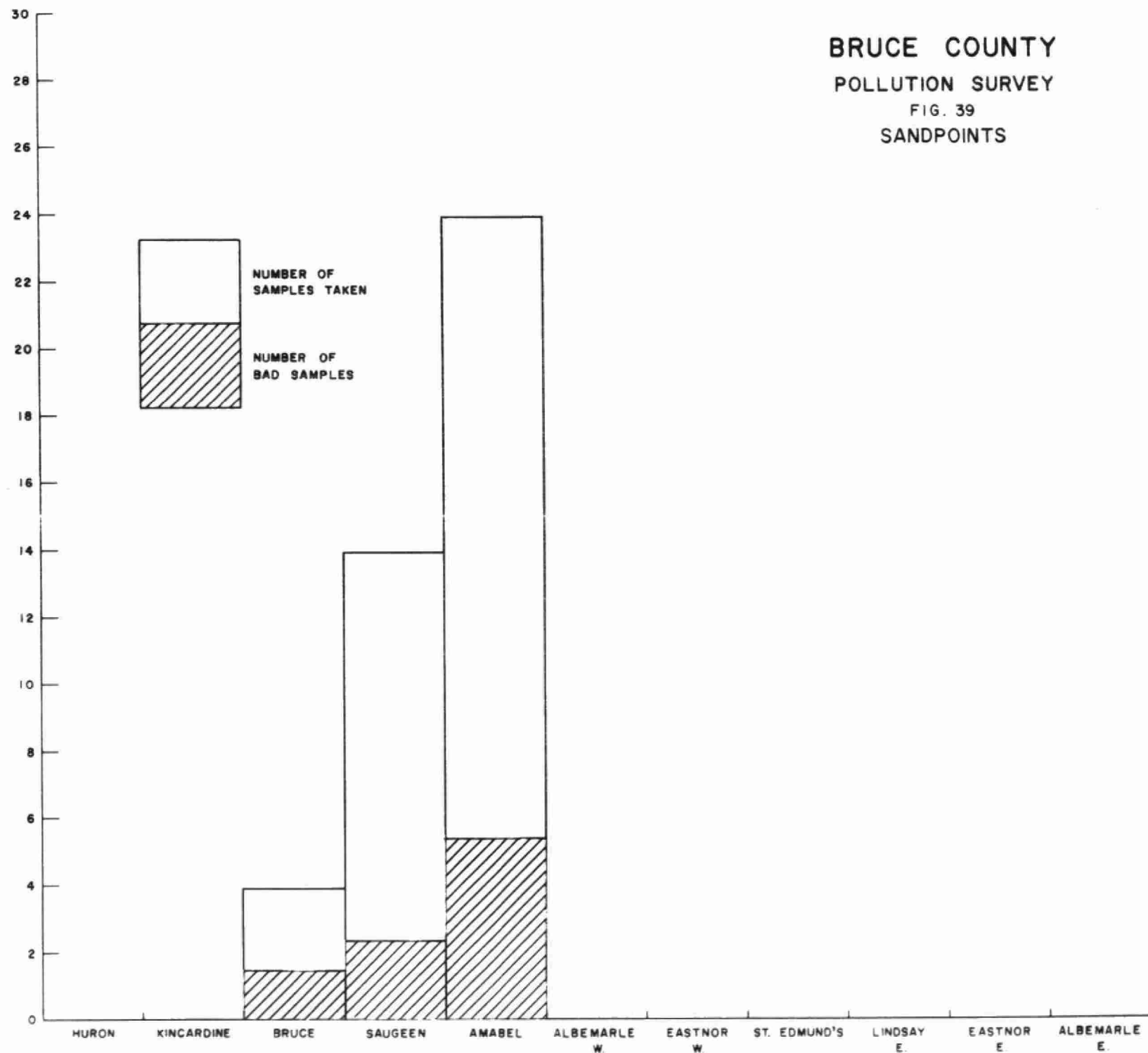
The bacteriological quality of the drilled, dug and sandpoint wells sampled during the survey is summarized in Figures 37, 38 and 39 respectively. Nearly all of dug well supplies sampled were grossly polluted and their future use as a domestic water supply is discouraged. Many of the dug wells were also severely contaminated, especially in the northern townships of St. Edmunds and Lindsay as well as Albemarle. The sandpoints sampled in the townships of Bruce, Saugeen and Amabel were of a better bacteriological quality than the dug wells in the same townships. The sandpoints in Saugeen Township were generally of a superior quality than the drilled wells in that area.

(c) Uses

Groundwater sources supply water for over 74 per cent of the private water systems in the county. Of this number of ground water supplies approximately 50 per cent consisted of drilled wells, 20 per cent were dug wells, 27 per cent were sandpoints, and the remainder







consisted mainly of spring supplies. On an overall basis, the least affected groundwater supplies in the County of Bruce were the sandpoints followed closely by the drilled wells. The poorest supplies were the numerous dug wells in the area.

Appendix 22 contains suggested well, sandpoint and spring construction techniques which should be used as a guideline when existing water supply systems are examined for proper construction and revamping where required.

1. 2 Surface Water

(a) River Basins

As mentioned previously, the county is drained by four large rivers in the area from Amable Township south. The peninsula drainage pattern consists of numerous small rivers and creeks flowing in a westerly direction carrying all surface drainage to Lake Huron. The four major rivers are the Pine and Pentangore rivers in the south and the Saugeen and Sauble rivers in the north. Water flow monitoring stations are established on the Saugeen and Sauble rivers. The flows referred to in Table 11 were recorded at a point roughly three miles northeast of Port Elgin on the Saugeen River and at Sauble Falls on the Sauble River. Flow records for these two watercourses are available back to the year 1914 on the Saugeen River and 1957 on the Sauble River.

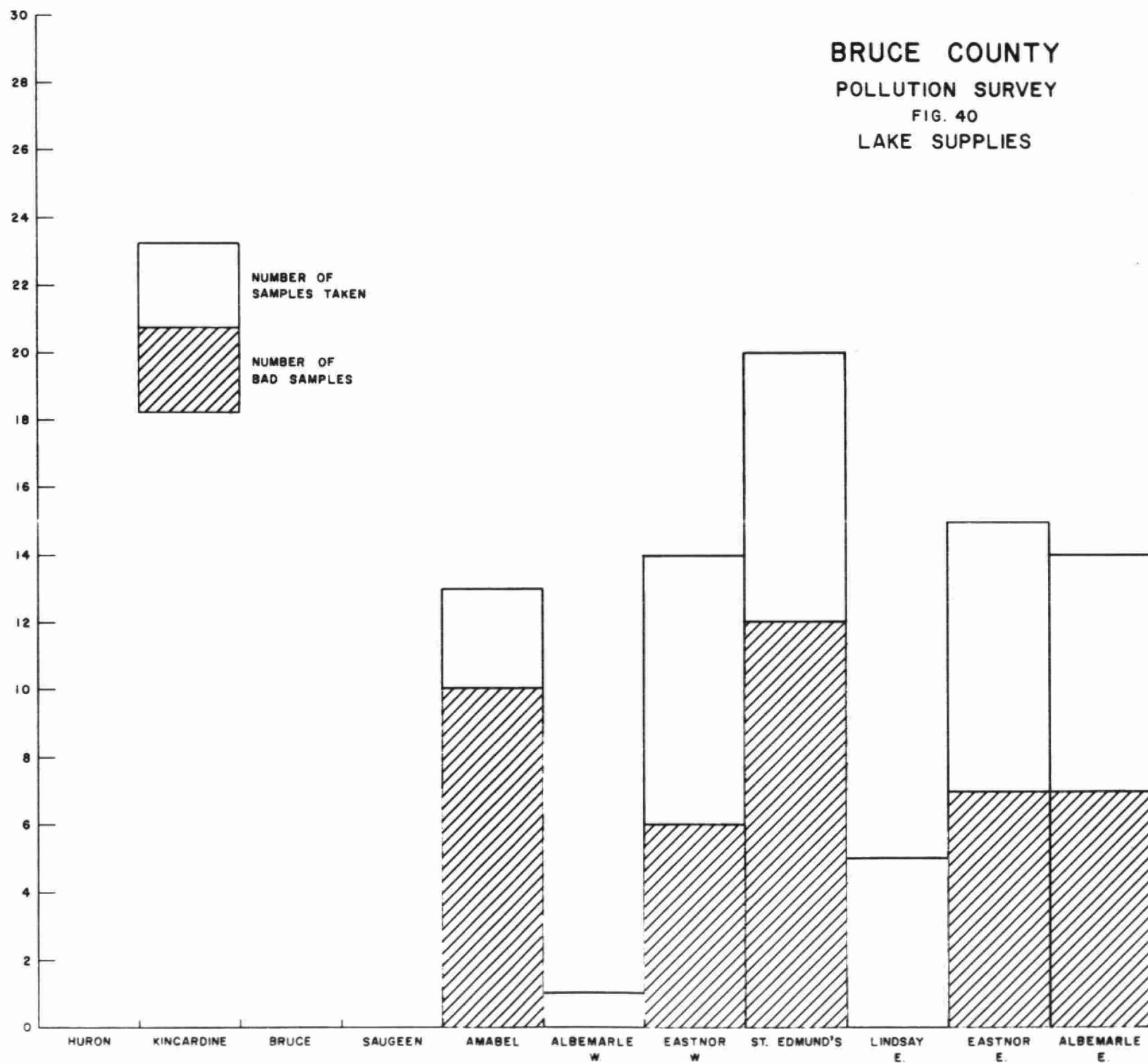
TABLE II
STREAM FLOW DATA

<u>GAUGE LOCATION</u>	<u>PERIOD</u>	<u>MEAN ANNUAL FLOW</u>	<u>DAILY FLOW</u>	
			<u>MAXIMUM</u>	<u>MINIMUM</u>
SAUGEEN RIVER AT PORT ELGIN	1966	2,060 CFS	14,200 CFS	282 CFS
	1965	1,880 CFS	26,200 CFS	306 CFS
	1964	1,210 CFS	11,200 CFS	242 CFS
	1957-1964	1,765 CFS	20,540 CFS	333 CFS
	1914-1957	1,970 CFS	31,640 CFS	202 CFS
SAU-LE RIVER AT SAUBLE FALLS	1966	448 CFS	5,600 CFS	15 CFS
	1965	454 CFS	5,240 CFS	36 CFS
	1964	301 CFS	1,960 CFS	22 CFS
	1957-1964	428 CFS	4,386 CFS	65 CFS

As is usually the case, streamflows recorded in the summer months are low. For this reason, the minimum daily flows are considered the critical factor in assessing water supply and waste assimilation capabilities.

(b) Lake Huron

The Lake Huron water because it is generally soft and low in mineral content, is a common source of domestic water along the Bruce County shoreline. In the northern area, the lake water is very cool and clear resulting in a supply which is preferred (both bacteriologically and chemically) as the source of supply, Note Figure 40. Dug wells in Albemarle, Eastnor, Lindsay and St. Edmunds are generally an inferior supply when compared to the bacteriological quality of the lake water.



(c) Uses

The major use to which surface water is put in the County is agricultural in nature. Crop irrigation and the watering of cattle is achieved using water obtained from the streams, creeks and rivers within the county. The Sauble River will permit such activities only during periods of high flows whereas the Saugeen River experiences good flows all year round. The Saugeen and Sauble rivers are receiving streams for numerous waste discharges of both treated and untreated nature. Treated sewage is also discharged to Lake Huron in Kincardine, Port Elgin and Douglas Point and to Georgian Bay at Wiarton.

The towns of Port Elgin, Kincardine, Southampton and Wiarton rely on Lake Huron and Georgian Bay as their source of drinking water as do a large number of cottage owners and the Douglas Point HEPC generating station. Minimum treatment consisting of chlorination and filtration is usually required with this source.

2. WASTE DISPOSAL PRACTICES

The greatest factor influencing the health of individuals where communal domestic sewerage facilities are not available is the proper disposal of human excrement. Improper disposal of human wastes may cause many diseases such as typhoid, dysentery, paratyphoid, and

various types of diarrhea, to be transmitted from one person to another. Widespread contamination of domestic water supplies could easily result if improperly treated wastes are allowed to gain access to water bodies, surface or ground, which are used as a source of supply. For this reason, every effort must be made to prevent such hazards and to dispose of all human wastes so that no opportunity will exist for the contamination of these supplies.

The disposal of excreta should be carried out so that it will not give rise to public health hazard by being accessible to children and will not violate laws governing water pollution or sewage disposal. These criteria can best be met by discharging domestic sewage to an adequate public sewerage system, however, where this is not possible individual household sewage disposal systems are necessary and the design, construction, installation and maintenance of these systems must be in accordance with the government requirements.

2.1 Individual Systems

The most common method of disposing domestic wastes along the Bruce County shoreline is through the use of the septic tank and tile field system. The use, design and construction of these systems must be approved by the Bruce County Health Unit.

To clarify operation of septic tank disposal systems, the following is a brief resume of its function. A septic tank system

consists of two main parts: (1) the septic tank which by settling out solids, prepares the sewage for absorption by the soil; and (2), the tile field which distributes the liquid to the soil. Perhaps the biggest misconception concerning septic tanks is the mistaken idea that purification of sewage occurs in the septic tank. The primary function of the septic tank is the removal of solids through bacterial action which breaks down the solid matter to liquids and gases. Sludge is removed from the tank periodically, usually once every three years is adequate, to ensure its continued efficient operation. Summer cottage owners should have their septic tanks pumped out to within 6 inches of the bottom when the cottage is closed for the season. The second part of the system, the tile field, consists of pipes laid with open joints in trenches so that liquid wastes can enter the soil to be absorbed by it.

The design of a septic tank system must, then, depend mainly on two factors: (1) the quantity of sewage to be disposed of; (2) the ability of the soil to absorb the liquified waste. The Ontario Department of Health has established certain limitations on the locations of septic tanks and tile beds. These limitations are shown graphically in Appendix 4, Figure 6.

Over 90 per cent of all residences visisted were using septic tank systems for the disposal of their excrement. The remaining 10 per cent utilized of cesspools and pit privys. It was found that of

those residences using septic tanks, roughly half employed separate connections for sink and laundry wastes. Such systems, if well-built and operating satisfactorily, can provide safe disposal of sewage utilizing the natural processes within the soil and confine the potentially dangerous wastes within well-defined areas. Malfunctioning septic tanks or flooded tile bed areas are a menace to health because of the disease-causing bacteria and viruses which may be present in sewage. Such a problem exists with the Sauble and Inverhuron beach areas where over-development of the beach region has resulted in the flooding of tile beds as evidenced by the ponding of wastes on the ground surface. These ponding areas pose a definite threat to human health as the above mentioned communicable diseases can be transmitted.

In the northern area (refer to Figure 1), the use of septic tank disposal systems is discouraged because the peninsula's overburden is predominantly bare bedrock with scattered soil cover ranging from a few inches to several feet. The lack of adequate soil in this region makes the construction and proper operation of such systems a near impossibility. Some home and cottage owners in the area were observed to be using filled disposal beds. This practice is also discouraged since the liquid waste percolates to the rock overburden before being adequately treated and may enter a surface or ground water area as runoff. Large lots with adequate soil type and covering

are necessary for the proper disposal of domestic wastes by this system in the northern area. Development should be rigidly controlled to prevent any further contamination of the water supplies in that area.

In the southern portion, the soil type for septic tank disposal systems appeared to be more desirable. The problem encountered in this area was due to the use of small lots and inadequate tile fields since many of the cottages were used on an annual rather than summer basis. Proper lot and septic tank disposal system design should effect proper treatment in this area.

2.2 Municipal Systems

Municipal sewage treatment plants are in operation at the present time in the towns of Port Elgin, Kincardine and Wiarton. Waste stabilization ponds serve Wiarton and Kincardine whereas a recently completed oxidation ditch sewage treatment facility is operating in Port Elgin. Final effluents from these sewage treatment facilities are discharged to Lake Huron and Georgian Bay. Communal sewerage systems must be constructed to service present and future congested areas.

APPENDIX 1

POLLUTION SURVEY OF SAUBLE BEACH

	<u>PAGE</u>
1. GENERAL	161
2. WATER SUPPLIES	162
3. WATER USES	163
4. WASTEWATER DISPOSAL	164
5. FIELD SURVEY	165
6. DISCUSSION	165
7. CONCLUSIONS	168
8. RECOMMENDATIONS	170
APPENDIX A - Bacteriological Analyses	171
APPENDIX B - Chemical Analyses	176

POLLUTION SURVEY OF SAUBLE BEACH

1. GENERAL

Sauble Beach is located on the eastern shore of Lake Huron in the Township of Amabel approximately 10 miles southwest of the Town of Wiarton. The area consists of a strip of white sandy beach roughly 5 miles in length stretching from Frenchman Point north to the southern limits of the Chief's Point Indian Reserve.

The overburden of this area is a sandy material of the Eastport series. This series, consisting of light grey dune sand or gravel with very little humus content, covers roughly 3,100 acres of Bruce County. It is of little agricultural value being used primarily for recreational purposes and as building sites for cottages.

As Sauble Beach is a well-known summer resort and recreational area, it is not hard to understand why the local economy is almost solely dependent on the tourist industry. Very little farming exists in the area and what little there is, is generally of the mixed variety.

The off-season population of the area is roughly 400 with the average summer population usually in the neighborhood of 10,000. During peak periods in the summer, the population reaches as high as 50,000 people due to the heavy influx of the tourists and cottage owners. The permanent resident population of the Township of Amabel,

as of the 1968 census, is listed as 1,562.

The actual beach area is split up into three sections: the Saugeen Indian Reserve, North Sauble and South Sauble.

2. WATER SUPPLIES

2.1 Municipal Water System

At the present time, there is no municipal water works or water system in Sauble Beach and with no plans for one in the future. In addition, no communal water supplies are known to be operating in this particular region.

2.2 Private Water Systems

Over 75 per cent of the residents in the Sauble Beach area obtain their water from sandpoints which average in depth from 6 to 20 feet. Although no major problems have been associated with this general class of wells, they frequently lack the quantity of water demanded by the consumers. The major complaint registered against these water supplies in this area is the high iron content evidenced by the characteristic taste and odour. North Sauble sandpoints are reportedly strong in sulphur odour and taste. As many lots in South Sauble are almost under water, the sandpoint water displays a swampy odour in addition to the iron problem.

The remaining 25 per cent of the residents obtain their water from drilled or dug wells and from Lake Huron. These supplies, bacteriologically, are not as good as the sandpoint supplies.

3. WATER USES

3.1 Recreational

The waters of Lake Huron provide Sauble Beach with a natural white sandy beach which is used by large numbers of vacationers for swimming and summer sports. All summer water activities such as boating, water skiing, swimming, etc. abound in Sauble Beach.

The waters of Lake Huron in this region have afforded one of the better if not the best summer recreational areas in the whole Bruce County. The South and North Sauble Beach areas are depicted in Figures 1 and 2 respectively.

3.2 Agricultural

Since agricultural endeavours in this area are very limited, the use of waters for this purpose is negligible. All existing farming is conducted further inland where soil conditions are better suited to this use.

4. WASTEWATER DISPOSAL

4.1 Municipal Waste Disposal

There are no municipal sanitary sewers or treatment facilities in Sauble Beach. Domestic wastes are generally disposed of through septic tank disposal systems, however, a number of pit privys are still employed in certain areas.

There is a small storm sewer outlet located at the foot of Hepworth Road. This sewer, intended to carry storm runoff out to the lake, discharges into the beach roughly 50 feet from the shoreline.

4.2 Private Waste Disposal

Approximately 90 per cent of the residents in Sauble Beach employ septic tank and tile field waste disposal systems. Due to the large population living along the shoreline, there are a large number of these systems in operation. So congested is the cottage development, that 3 - 4 cottages (all with separate septic tank systems) are located on single lots. The majority of the tile beds seem to be leading towards the beach.

There is in operation one public washroom which serves the thousands of people that frequent the public beach (Refer to photograph presented in Figure 8). In addition, on the private beach, owned and operated by the Saugeen Indians, four washroom facilities

are in use at the present time with another under construction. Admittance to the beach is achieved by payment of a nominal fee collected to pay costs of maintenance of the beach and washroom facilities.

5. FIELD SURVEY

The actual field work for this survey was carried out during the months of June - September, 1969. The large portion of the field work was completed by the Bruce County Health Unit during the months of June - August, 1969. An additional survey was carried out on September 2, 1969 by the OWRC's District Engineers Branch, Division of Sanitary Engineering. The bacteriological results obtained are listed in Appendix A and the chemical results in Appendix B.

6. DISCUSSION

All bacteriological and chemical results of analyses performed on samples submitted during all field surveys of the Sauble Beach area may be found in Tables 1-2.

Of the total 51 bacteriological samples taken by the Health Unit on June 17 and August 26, 1969, 100 per cent showed the presence of coliform organisms, along the southern beaches (see Figure 1 for sampling station and Appendix A for the sample results). Coliform organisms are generally used as indicators of pollution, since these

bacteria are found in the intestinal tract of warm-blooded animals. For natural watercourses, a guideline of 2,400 organisms per 100 ml of sample is usually adhered to and higher counts usually entail closing the area to human use. The Health Unit lake water samples were taken in roughly 1-2 feet of water along the shore. Using the aforementioned limit, two of the 51 samples were adverse. The highest coliform organism count recorded was 1,200,000 per 100 ml of sample with a corresponding faecal coliform count of 360 per 100 ml of sample. Because of the great risk of ingestion during swimming, faecal coliform organisms present a serious health hazard and should not be present in any concentration. The higher coliform counts are directly related to the amount of sewage present in the water.

During the survey conducted in September, 1969, a total of 24 samples were obtained, 21 of which were taken from the ponding areas along the beach. Figure 2 is a map of the northern section showing the location of several ponding areas (refer to Figure 6 of the main report which shows a photograph of one of the ponds). Coliform organism counts as high as 490,000 per 100 ml of sample were recorded in analysis of these samples with corresponding faecal coliform counts as high as 78,000 per 100 ml of sample. Faecal coliforms are normally inhabitants of the intestinal tract of warm-blooded animals and are carriers of waterborne diseases such

as typhoid fever, dysentery, paratyphoid and some virus diseases including infectious hepatitis. It cannot be overemphasized that these waters are an extreme health hazard to the public.

On the basis of the laboratory results, it can be said that definite pollution of the lake water is occurring. The presence of faecal coliform organisms in the water samples indicates that human wastes are gaining access to the recreational waters of the area. The major source of such pollutants (especially in the ponding area) is felt to be from malfunctioning or improperly constructed sewage disposal systems. Septic tank systems, under normal conditions, should provide adequate waste disposal along the shoreline since the soil conditions are well-suited to the purpose. A good sandy soil provides an excellent means for filtering of liquid wastes from tile fields. However, in this particular area, the number of septic tank and tile field systems is enormous and added to this the fact that 3-4 cottages are located on one lot, has caused the soil to become supersaturated with liquid wastes. As a result, excess liquid is accumulating in low lying areas on the beach. It is reported that the majority of the tile fields lead toward the beach, a fact which supports the preceding argument.

Private drinking water supplies in the area were also sampled. Most of the supplies are sandpoints which showed no or very little

coliform contamination. However, without error, the dug well and lake supplies tested were all found to be adverse by virtue of coliform organism counts. A drinking water supply is considered safe for human consumption when the coliform count per 100 ml of sample is 0 (limits as set by the Ontario Water Resources Commission). Faecal organisms, indicators of domestic wastes in the water, should not be present in any quantities in a drinking water supply. The presence of this bacteria in a drinking water supply requires immediate treatment and therefore, all surface waters should be disinfected either by chlorination, by boiling for a minimum of 10 minutes, or any other acceptable method, prior to human consumption.

To summarize, the existing pollution of the Sauble Beach resort area can be attributed to the following: 1) congested cottage development resulting in extensive loading of the soil by liquid wastes from a large number of septic tanks which causes ponding of these wastes on the surface, 2) storm drainage from the storm sewer emptying onto beach at the foot of Hepworth Road (see photograph presented as Figure 9), 3) the great number of swimmers that crowd the beach during the summer months (see photograph presented as Figure 7).

7. CONCLUSIONS

The Sauble Beach area of Amabel Township is the largest and

most favoured public recreational area in Bruce County, however, the increasing cottage development along the shoreline has resulted in severe overcrowding and associated over-taxing of the natural resources in the area.

There are no known communal water supply systems in the Sauble Beach area. Most private homes obtain their domestic water from individual sandpoints which have a low yield but supply bacteriologically acceptable water in most cases. Since all surface waters are subject to contamination from various sources, it is recommended that they be disinfected prior to use. To ensure that this process is effective at all times, future development on any large scale should be based on communal systems. These systems should use Lake Huron or drilled wells as the water supply because sandpoints are unable to supply a large demand. It is also encouraged that the ownership of these systems be deeded to the municipality.

The domestic waste disposal problem in Sauble Beach is critical. This situation is due to the congested cottage development and it is not uncommon to find as many as 4 cottages, each with their own septic tank and tile field, on one lot. Further building in this area should be curtailed and a complete sewerage system should be installed as soon as possible to eliminate the existing public health hazards. The sewage collector system should service the cottages

along the beach as well as the small commercial area located at the foot of the Hepworth Road. The results of the survey indicated that domestic sewage from the latter area is gaining access to the storm drain network.

The existing official plan of Amabel Township should be examined to ensure that the findings of this survey can be properly implemented.

8. RECOMMENDATIONS

1. Communal water and sewage facilities should be installed to service the north and south beach areas as well as the commercial establishment at the foot of Hepworth Road.

2. Drilled wells or Lake Huron should be utilized as the domestic water source.

APPENDIX A

SAUBLE BEACH POLLUTION SURVEY

- BACTERIOLOGICAL RESULTS -

TABLE NO. 1 - SOUTH SAUBLE BEACH
TABLE NO. 2 - NORTH SAUBLE BEACH

TABLE NO. 1

SAUBLE BEACH

- Bacteriological Results -

Lake Huron

- South Sauble -

<u>Sample No.</u>	<u>Coliforms</u>	
	<u>Total</u>	<u>Faecal</u>
1	50	20
2	80	6
3	90	30
4	1,200	20
5	70	26
6	60	6
7	40	20
8	10,000	10,000
9	70	10
10	115	62
11	20	10
12	Broken	
13	90	10
14	70	12
15	25	16
16	400	140
17	15	8
18	110	82
19	35	20
20	800	100
21	290	216
22	50	40
23	76	76
24	65	58
25	90	30
26	100	100
27	85	70
28	85	38
29	40	10
30	25	16

TABLE NO. 1 (cont'd)

<u>Sample No.</u>	<u>Coliforms</u>	
	<u>Total</u>	<u>Faecal</u>
31	70	8
32	130	20
33	40	10
34	Broken	
35	1,200,000	360
36	45	8
37	100	30
38	20	20
39	20	8
40	140	18
41	15	12
42	150	20
43	20	18
44	Broken	
45	140	10
46	30	14
47	20	10
48	20	20
49	450	30
50	10	6
51	30	12

TABLE NO. 2

- Bacteriological Results -

Lake Huron

- North Sauble -

<u>Sample No.</u>	<u>Coliforms</u>	
	<u>Total</u>	<u>Faecal</u>
1	2,300	200
2	14,000	400
3	31,000	300
4	3,600	200
5	16,000	1,300
6	48,000	600
7	3,600	300
8	64,000	300
9	7,000	500
10	15,000	200
11	12,000	4,100
12	8,000	900
13	2,400	200
14	19,000	1,100
15	34,000	1,800
16	490,000	78,000
17	16,000	1,900
18	1,900	100
19	1,900	100
20	9,000	3,000
21	360	300
22	300	112
23	210	14
24	75	30
25	120	16
26	110	12
27	125	20
28	190	52
29	800	100
30	110	20
31	140	22
32	150	38

TABLE NO. 2 (cont'd)

<u>Sample No.</u>	<u>Coliforms</u>	
	<u>Total</u>	<u>Faecal</u>
33	150	24
34	250	6
35	150	44
36	160	34
37	300	52
38	200	12
39	110	36
40	600	100
41	220	112
42	400	100
43	100	40
44	240	120
45	130	66
46	400	42
47	43,000	400
48	120,000	700
49	100,000	1,500
50	460,000	15,000
51	18,900	200
52	1,600	160
53	11,200	200
54	9,400	160

APPENDIX B

SAUBLE BEACH POLLUTION SURVEY

- CHEMICAL ANALYSES -

TABLE NO. 3

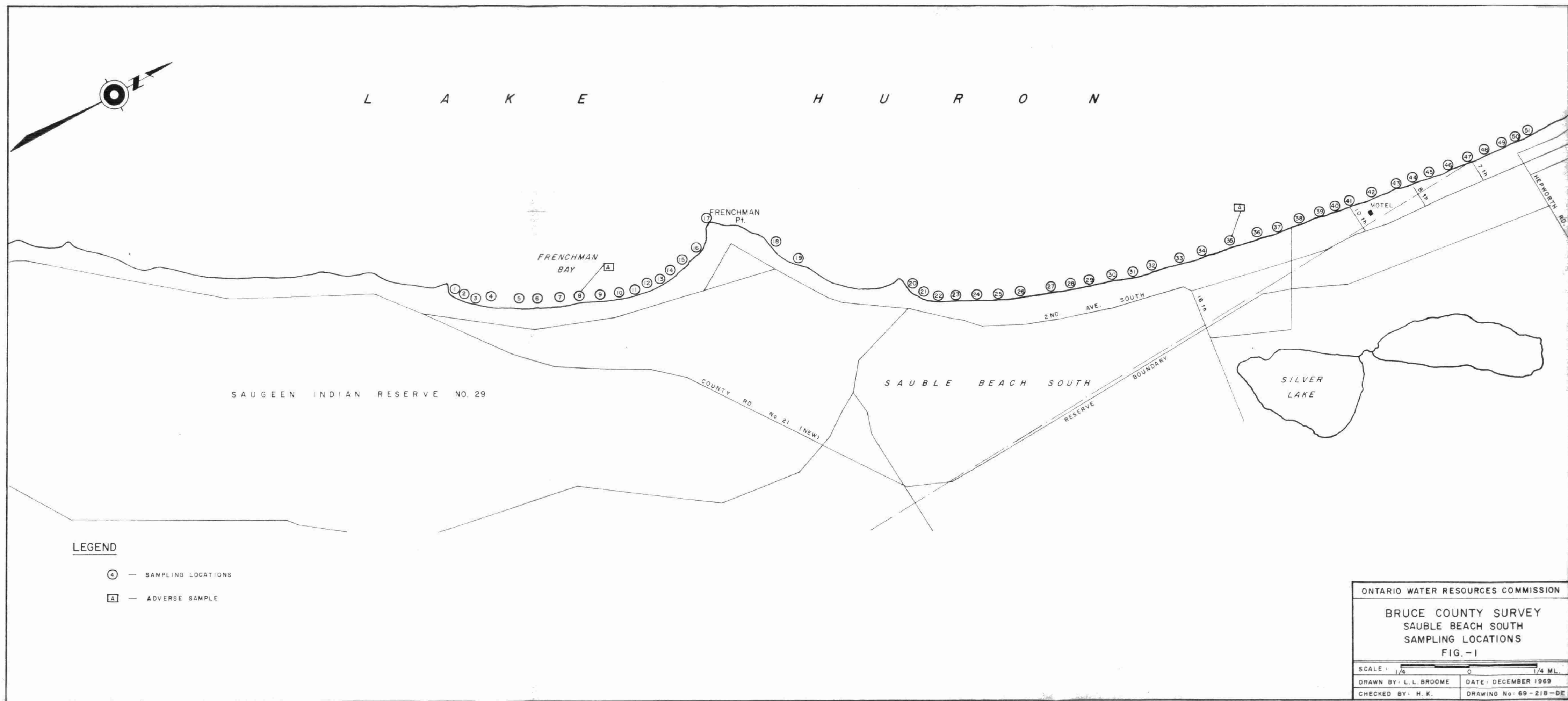
- Chemical Results -

Storm Drain

Foot of Hepworth Road

<u>Date Sampled</u>	<u>5-Day BOD</u>	<u>SOLIDS</u>		<u>Diss.</u>	<u>Anionic Detergents as ABS</u>
		<u>Total</u>	<u>Susp.</u>		
September 2, 1969	2.0	380	5	375	0.2

Note: All results reported in ppm.



LEGEND

- ④ — SAMPLING LOCATIONS
- [A] — ADVERSE SAMPLE

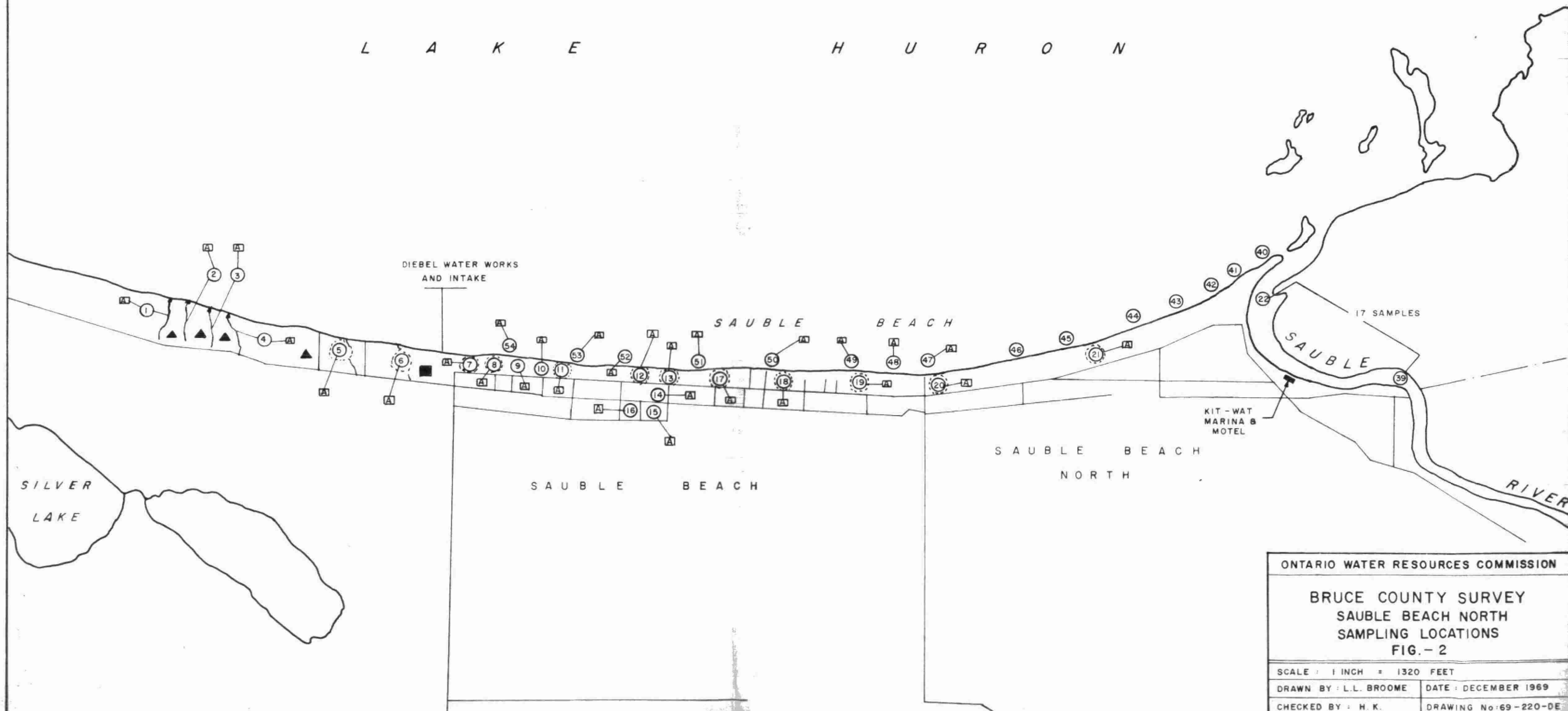
ONTARIO WATER RESOURCES COMMISSION	
BRUCE COUNTY SURVEY SAUBLE BEACH SOUTH SAMPLING LOCATIONS FIG.-1	
SCALE: 1/4 0 1/4 ML.	
DRAWN BY: L. L. BROOME	DATE: DECEMBER 1969
CHECKED BY: H. K.	DRAWING No: 69-218-DE



LEGEND

- ⑨ - SAMPLING LOCATIONS
- [A] - ADVERSE SAMPLE
- ▲ - PRIVATE WASHROOM (FEE CHARGED FOR USE)
- - PUBLIC WASHROOM
- - PONDING AREA

L A K E H U R O N



ONTARIO WATER RESOURCES COMMISSION

BRUCE COUNTY SURVEY SAUBLE BEACH NORTH SAMPLING LOCATIONS FIG.- 2

SCALE : 1 INCH = 1320 FEET

DRAWN BY : L.L. BROOME DATE : DECEMBER 1969

CHECKED BY : H. K. DRAWING No: 69-220-DE

APPENDIX 2

POLLUTION SURVEY OF LION'S HEAD

	<u>PAGE</u>
1. INTRODUCTION	181
2. GENERAL	181
3. WATER SUPPLIES	182
4. WATER USES	184
5. WASTE DISPOSAL	185
6. FIELD SURVEY	187
7. DISCUSSION	188
8. SUMMARY AND CONCLUSIONS	191
9. RECOMMENDATIONS	192
APPENDIX A - Analytical Results	193

POLLUTION SURVEY OF LION'S HEAD

1. INTRODUCTION

Two pollution surveys of the Village of Lion's Head were carried out by the OWRC's District Engineers Branch, Division of Sanitary Engineering, on July 9 and September 4, 1969. Both surveys were carried out upon the request of the Eastnor Horticultural Society who lease the Lion's Head Beach Park and feel that two storm sewers on either side of their swimming area are causing a pollution problem in Isthmus Bay.

2. GENERAL

The Village of Lion's Head is located at the mid-point of the Bruce Peninsula between Wiarton and Tobermory. Isthmus Bay, a small inlet on the west shore of Georgian Bay, serves as a basin around which the village and several cottage developments are situated. The geographical location of the village affords natural drainage into Isthmus Bay with a maximum rise in elevation of 80 feet from the water level of the bay. The overburden in the area is a well sorted outwash of the Sargent Series consisting of sandy loam or well sorted sand with gravel.

The village is largely a summer tourist centre with a year round population of 432 (a plan view of Lion's Head is presented in

Figure 1). The seasonal population of the village and immediate vicinity is estimated at 2,200. There are no industries in the village and the local economy is based almost entirely on tourism and related retail services. A few of the residents take up farming in the immediate area.

2.1 Past Pollution Surveys

The first pollution survey of the Village of Lion's Head was carried out by the District Engineers Branch in August of 1964. The results of that survey indicated that some domestic wastes were entering municipal storm drains, resulting in pollution of Isthmus Bay. At that time, it was recommended that the village council make every effort to have illegal connections to the municipal storm drains severed.

There have been no additional pollution surveys carried out since that time.

3. WATER SUPPLIES

3.1 Municipal Water System

An OWRC survey was carried out in 1959 to determine municipal water supply requirements and the approximate costs of providing same. The estimated cost of \$95,000 was felt to be excessive and no action

was taken on the survey proposals.

3.2 Communal Water System

With the rejection by the municipality of a water supply system, a number of interested residents formed the Lion's Head Pure Water Association and constructed a water works in 1960 that now supplies some 50% of the population through 82 services.

The water is drawn from Isthmus Bay through a 3 inch diameter galvanized iron pipe that extends 1,200 feet to the screened intake which lies in 23 feet of water. The pumphouse, located on the shoreline at the north end of Joseph Street, houses the pumping and chlorination equipment. Three pumps with a total rated capacity of 9,000 G.P.H. supply the system and a 1,500 F.P.H. piston pump acts as a standby. The water is chlorinated and pumped to the distribution system which consists mainly of 2 inch to 4 inch diameter plastic mains. Pressure in the system is maintained by two 200 U.S. gallon steel pressure tanks with a 60-90 psi pressure differential. Early in 1969 a standby chlorinator and water meter were added to the system.

3.3 Private Water Systems

In addition to the above system, several private water supplies serve the remaining population. Drilled wells serve approximately

20% of the residents, dug wells 20%, private lake supplies 6%, and a few residences are served by spring supplies. Most of these supplies are checked periodically by the Bruce County Health Unit and some have been found to contain coliform bacteria.

4. WATER USES

4.1 Municipal

Since there is no industry in Lion's Head the several water supplies serving the village are used entirely for domestic consumption.

4.2 Recreational

The shores of Isthmus Bay provide the village with a natural sand beach used extensively for swimming and summer sports. The Lion's Head Beach Park adjacent to the village is controlled and maintained by the Eastnor Horticultural Society. This conservation park also has an ideal swimming area which is buoyed off and available for public use.

The water of Isthmus Bay has been noted in the past years for its purity and has afforded one of the better summer recreational areas in Bruce Peninsula with fishing and boating being two of the favourite pastimes of the summer tourists.

4.3 Agricultural

The agricultural use of the waters associated with this survey is negligible since the few farms in the area are located in the Township of Eastnor.

5. WASTE DISPOSAL

5.1 Municipal Waste Disposal

There are no sanitary sewers in the village. Domestic wastes are generally disposed of through septic tank disposal systems with some residences using seasonal holding tanks. The occasional outdoor pit privy is still in use.

Three storm sewers exist in the village, two municipal and one private. These 12" C.S.P. sewer outlets discharge directly into the bay on either side of the Lion's Head Beach Park at Scott Street and Webster Street (see Figure 1 and 2).

During the survey, it was reported that one of the sewers emptying into the bay in the vicinity of Webster Street was used as a private drain from the old hotel. This sewer begins behind the old hotel that now serves as an old folks nursing home, and is presently draining a spring fed swampy area behind this building. In addition, a municipal sewer runs from Main Street down Webster Street and empties into the bay. The two sewers are about 10' apart and located

50 feet from the south end of the swimming area. The private sewer is felt to be the one that discharges continuously whereas the municipal sewer flows intermittently.

The Scott Street sewer begins in the vicinity of Everatt and Main streets and runs down Scott Street where it empties into the bay at a point approximately 10 feet from the north end of the swimming area. This sewer also discharges continuously with great variations in flow.

5.2 Refuse Disposal

The village provides its residents with weekly garbage pick-up throughout the year. The refuse is disposed of in an abandoned gravel pit located in Eastnor Township to the southwest of the village. Pollution of ground or surface waters from the dump site did not appear to be significant at the time of the survey.

6. FIELD SURVEY

The field work associated with this survey was carried out on July 9 and September 4, 1969. Surveys of this nature, when performed at the beginning and end of the summer season, help to better evaluate the pollution effects of the summer population. During both surveys, the temperature was approximately 75°F and the sky was sunny and clear. No heavy rainfall had occurred for several days

preceding the surveys.

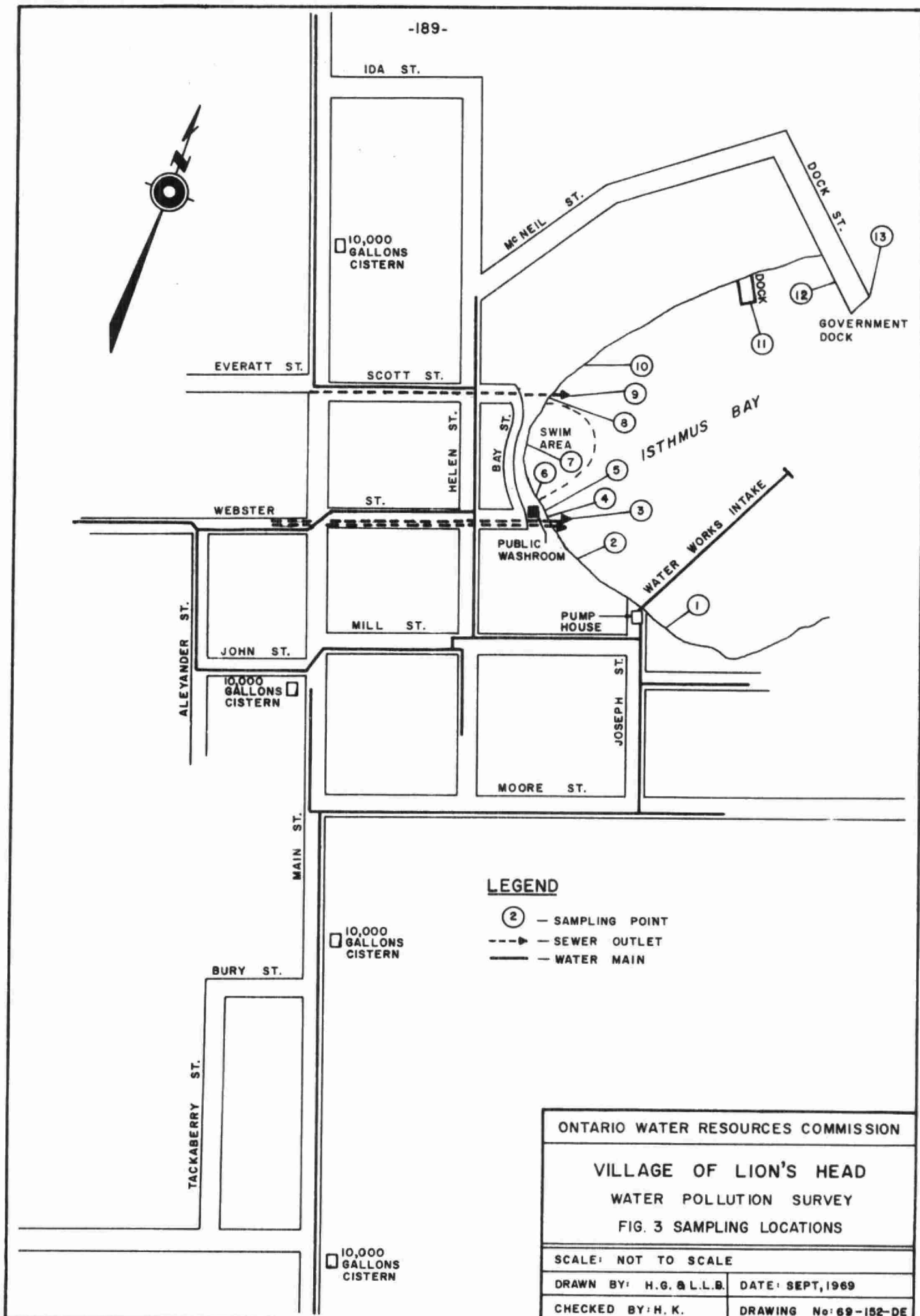
In addition to these two surveys, the water of Isthmus Bay were sampled on two other occasions by the Bruce County Health Unit. The sampling by the Health Unit was carried out on June 26 and August 18, 1969 following the same sampling path utilized previously by the OWRC staff.

7. DISCUSSION

A total of 47 bacteriological and 8 chemical samples were obtained from Isthmus Bay during the course of this survey. The analytical results of the samples are listed in Appendix A under the appropriate sampling dates. The sampling points are depicted in Figure 3.

Total coliform counts in excess of the 2,400 organisms per 100 ml normally considered acceptable for natural watercourses were obtained in 26 per cent of all samples. The coliform count increased with the summer population and in September, 42 per cent of the samples collected were in excess of this objective.

The presence of faecal coliform organisms (those associated with the faecal excrement of warm blooded animals) was detected in 96 per cent of all samples taken. Of all the samples analyzed in June, 77 per cent indicated their presence but as the summer progressed,



this percentage increased to 92 in September. These results indicate that human wastes are gaining direct access to the bay area and consequently a potential health hazard exists. During September, concentrations of 60,000 faecal coliforms per 100 ml were obtained, indicating the presence of raw sewage. Counts of this magnitude suggest that illegal sanitary connections to the storm sewer may be a contributing factor to the pollution of the bay. All such connections should be severed.

In addition to the pollution caused by the storm sewer discharges, it is felt that other minor sources such as:

- 1) inadequate sewage disposal systems serving permanent homes and cottages;
- 2) large concentrations of yachts and pleasure craft utilizing the public docking facilities; and
- 3) the great number of swimmers which crowd the beach during the summer months, all contribute to the increased pollution during the summer months.

To curtail pollution of Georgian Bay by domestic wastes discharged from the storm sewers, a sewer separation program should be started and communal sewage treatment facilities should be provided for all domestic wastes.

The Village Council has no plans for a municipal sewage treatment plant at the present time, however, on October 7, 1968,

Council retained the services of A. M. MacKay and Associates Limited to prepare a Master Storm Sewer Plan for the entire catchment area of the village that could feasibly be drained to Isthmus Bay. The report was prepared on January 13, 1969 and recommended a stayed program to be governed by the financial limits of the village. The Council has temporarily rejected this proposal on the basis that it is economically unfeasible.

The new OWRC boating regulations will aid to discourage pleasure craft owners from adding to the pollution problem.

The chemical samples obtained during the survey had a very low BOD (maximum 1.4 and minimum 0.6), indicating that the wastes are highly diluted.

8. SUMMARY AND CONCLUSIONS

During the summer months of 1969, a pollution survey of Lion's Head was carried out to determine the effect of the summer population and the village on the Lake Huron waters.

The results of the bacteriological analyses indicated that a potential health hazard exists in the Isthmus Bay area due to the combined effects of the increased summer population, their associated activities, and the three storm sewers. The latter appeared to have the greatest effect upon the beach water quality because of the high

concentrations of faecal coliform bacteria and the strategic location of their discharges (one on each end of the beach).

As an immediate course of action, steps should be taken to sever any illegal connection to the storm drains. A Consultant Engineer should also be retained by Council for the purpose of developing costs for a communal sewerage program. The installation of separate storm and sanitary sewers is essential in curtailing pollution of Isthmus Bay and to properly treat the domestic sewage.

9. RECOMMENDATIONS

1. The existing storm sewer drainage system should be separated.
2. A communal sewerage system should be installed.

APPENDIX A

VILLAGE OF LION'S HEAD

TABLE 1 - BACTERIOLOGICAL ANALYSES

TABLE 2 - CHEMICAL ANALYSES

TABLE NO. 1

VILLAGE OF LION'S HEAD

- Bacteriological Analysis -

Isthmus Bay

<u>Sampling Point</u>	<u>Faecal Coliforms</u>			
	<u>June 26</u>	<u>July 9</u>	<u>August 18</u>	<u>September 4</u>
1	122	38	12	10
2	14	10	60	120
3	800	30	4,100	60,000
4	96	2	36	3,000
5	4	-	46	3,000
6	4	-	24	7,000
7	6	6	40	15
8	0	-	50	10
9	5,000	14	6,400	4,300
10	2	-	2	65
11	0	-	8	-
12	2	0	2	0
13	0	2	2	40
<u>Total Coliforms</u>				
1	135	172	25	20
2	85	484	350	900
3	6,000	4,100	100,000	60,000
4	17,600	132	160	3,000
5	195	-	130	3,000
6	800	-	1,800	9,000
7	200	108	305	170
8	30	-	280	150
9	5,000	336	48,000	20,000
10	5	-	25	600
11	0	-	105	-
12	2	4	50	0
13	155	4	50,000	90

Note: All results reported in ppm

TABLE NO. 2

VILLAGE OF LION'S HEAD

- Chemical Analyses -

Isthmus Bay

July 9, 1969

<u>Sampling Point</u>	<u>5-Day BOD</u>	<u>SOLIDS</u>		<u>Diss.</u>	<u>ABS</u>
		<u>Total</u>	<u>Susp.</u>		
1	0.6	200	5	195	0
3	0.8	530	5	525	0
9	0.6	440	5	435	0
12	0.8	200	5	195	0

September 4, 1969

3	1.2	340	5	335	-
7	1.0	155	5	150	-
9	1.4	430	5	425	-
13	0.6	130	5	125	-

Treated Drinking Water

<u>Hardness as CaCO₃</u>	<u>Alkalinity as CaCO₃</u>	<u>Iron as Fe</u>	<u>Chloride as Cl</u>	<u>pH at Lab</u>
94	75	0.05	6	8.3

Note: All results reported in ppm except pH.

APPENDIX 3

POLLUTION SURVEY OF TOBERMORY

	<u>PAGE</u>
1. GENERAL	197
2. WATER SUPPLIES	198
3. WATER USES	199
4. WASTE DISPOSAL	200
5. FIELD SURVEYS	201
6. DISCUSSION	201
7. SUMMARY AND CONCLUSIONS	205
8. RECOMMENDATIONS	206
APPENDIX A - Analytical Results	207

POLLUTION SURVEY OF TOBERMORY

1. GENERAL

The community of Tobermory is located at the northern tip of the Bruce Peninsula in the Township of St. Edmunds. This picturesque community is situated at the end of the famed Bruce Trail which follows the Niagara Escarpment from the City of Niagara Falls north to Tobermory.

The overburden of this area is a very stony material of the Breypen series. As such it consists of bare bedrock, which is mainly limestone, with small pockets of soil or muck scattered throughout. This type of soil cover predominates in the Bruce Peninsula entailing some 219,200 acres. Such a soil type is best suited for forest development.

The permanent resident population of this community is roughly 350 with the summer population rising to 2,250. The permanent resident population of the Township of St. Edmunds is only 467, most of which reside in and about Tobermory.

The local economy of the area is based primarily upon the tourist industry and its related retail services. However, a few residents engage in commercial fishing for their livelihood. In addition to the tourist trade, the local economy is stabilized by the mixed farming conducted in the vicinity.

2. WATER SUPPLIES

2.1 Municipal Water System

At the present time, there is no municipally operated water works in Tobermory. All residents in the community have their own private sources of supply. No communal water works are known to be operating in the community.

2.2 Private Water Systems

The majority of the permanent residents in Tobermory obtain their drinking water from drilled wells. These wells, averaging 60 feet in depth, range from 47 to 150 feet in depth. No treatment is given to these supplies as bacteriological quality is, for the most part, satisfactory. The most common complaint registered against the supplies is the high iron content.

Most residents and commercial establishments draw their drinking water from the bay. Of the lake water supplies test, roughly 40 per cent are treated prior to consumption either by chlorination or filtering. Because of the high concentrations of bacteria present in this source, especially in the summer months, treatment of the supply should include both disinfection and filtering to be truly effective.

The greatest complaint recorded during the survey concerned

the presence of an obnoxious fishy odour which tended to increase in the summer months. This condition is usually related to the presence of blue-green algae, however, biological samples were not obtained to confirm this. It seems reasonable to assume that this is the case since the odour increases during the summer time when algae productivity also increases.

3. WATER USES

3.1 Recreational

The waters of Tobermory Bay are split into two natural harbours, Big Tub Harbour and Little Tub Harbour. Every summer these waterways are inundated with pleasure craft of all types and sizes. All other summer water activities such as swimming, water skiing, and skin diving abound in the area. One of the major attractions of the region is the ideal surroundings for skin diving enthusiasts afforded by the clear deep water.

3.2 Agricultural

As very little agricultural endeavours are carried on in the vicinity of Tobermory, little water is actually put to such use. Irrigation of crops and watering of cattle are achieved by using water drawn from numerous creeks and rivulets in the surrounding region or

directly from the bay or lake.

4. WASTE DISPOSAL

4.1 Private Waste Disposal

There are no sanitary sewers or associated treatment facilities in the community of Tobermory. All domestic wastes are directed to septic tank disposal systems which make up 90 per cent of the sewage disposal facilities employed by those residences visited during the field survey. The occasional outdoor pit privy is still in use although they are gradually being replaced by the septic tank and tile field systems.

4.2 Refuse Disposal

The Township of St. Edmunds provides the taxpayers with weekly garbage collection throughout the year. The refuse disposal site is located approximately 1 $\frac{1}{4}$ miles from Tobermory. Pollution of the ground or surface water supplies in this area by the refuse site does not seem to be significant.

4.3 Pleasure Craft Pump-out Stations

Owing to the large number of pleasure craft using the local waters, a pump-out facility was installed in Tobermory Harbour for the removal of wastes from on-board holding tanks. A new OWRC regulation

forbidding discharge of sewage into natural waterways by pleasure craft is now being strictly enforced. Such legislation will help to reduce the pollution of local waters by the pleasure craft.

5. FIELD SURVEYS

The field survey work necessary for the writing of this report was carried out on August 13, 1969 by the local Health Unit and also on September 3, 1969 by the District Engineers Branch of the OWRC.

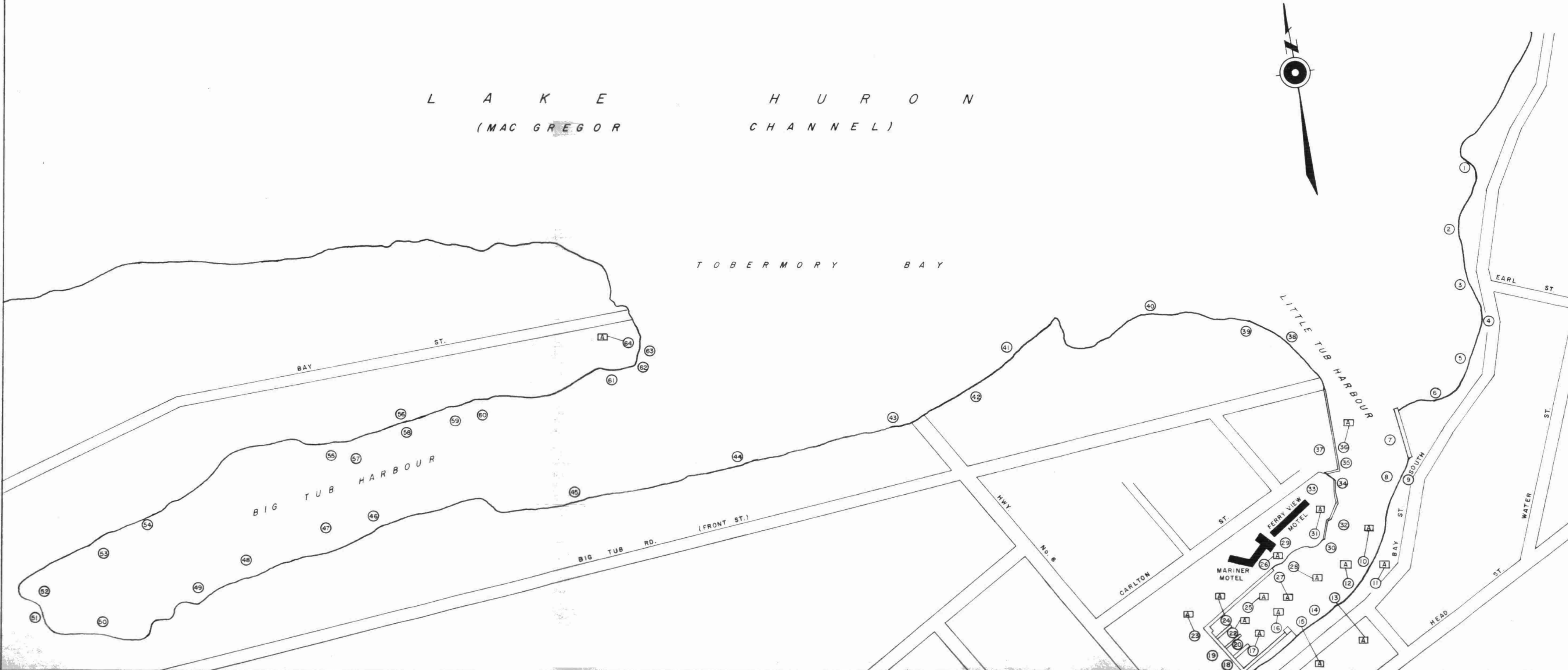
A total of 64 water samples were obtained by both groups for bacteriological analysis and two chemical samples were taken during the second survey.

The results of the sample analyses are reported in Appendix A and the location of the sampling stations are presented in Figure 1.

6. DISCUSSION

Of the 46 samples taken by the Health Unit for bacteriological analysis, roughly 66 per cent showed the presence of faecal coliforms. The presence of such bacteria indicates the water to be potentially dangerous as these organisms are normally inhabitants of the intestinal tract of warm-blooded animals and therefore, associated with their faecal discharges.

Over 72 per cent of the samples taken by the OWRC showed



LEGEND

- ⑨ — SAMPLING LOCATIONS
- Ⓐ — ADVERSE SAMPLE

ONTARIO WATER RESOURCES COMMISSION

**BRUCE COUNTY SURVEY
TOBERMORY BAY
SAMPLING LOCATIONS
FIG.-1**

SCALE : 1 INCH = 264 FEET	
DRAWN BY : L.L.BROOME	DATE : DECEMBER, 1969
CHECKED BY : H.K.	DRAWING No : 69-219-DE

the presence of faecal coliforms. The 18 samples obtained were taken at a distance of 2-10 feet offshore. The highest coliform counts recorded were found in those samples taken in the vicinity of the docks in Little Tub Harbour.

The laboratory analyses of both pollution surveys indicate that the waters of Tobermory Harbour are, in general, polluted.

Faecal coliform counts as high as 2,400 organisms per 100 ml and total coliform organisms up to 2,500,000 per 100 ml were obtained during this survey. Since the harbour is used as a water supply for several commercial establishments in the community, a potential public health hazard exists. When water supplies contain coliform bacteria of this magnitude, treatment by chlorination only cannot be guaranteed and several processes must be applied together to ensure a safe potable supply at all times.

One of the most noticeable causes of the bay water pollution is the discharge of garbage and sewage from the large number of pleasure craft using the waters. Visual observation of garbage flowing down the harbour verifies this fact. It is hoped that the new boating regulation will put an end to this problem, since they forbid the dumping of raw sewage into natural waterways by pleasure craft and require that all craft be equipped with holding tanks which can be pumped out on shore. At present, only one such facility exists in Tobermory Harbour

although another station would appear to be necessary. It is felt that stricter enforcement of the new boating regulations will certainly reduce the pollution from this source.

Another source of pollution can be attributed to the methods of waste disposal practiced by the local inhabitants. As mentioned under Section 4, septic tank and tile bed systems are the most predominant method employed. Unfortunately, the soil conditions of the area are not conducive to their efficient operation since a sandy type of soil is a prime prerequisite for satisfactory disposal of sanitary wastes in this manner. The rocky overburden acts as a very poor filter with the result that liquid effluent from the tile beds flows unheeded along the rock into the waters of the harbour.

It is essential that communal water and sewage treatment facilities be installed in Tobermory to ensure the residents and visitors a safe source of supply at all times. With proper planning of future subdivision and cottage sites, the cost of these systems may become more realistic. If the predominant rock overburden makes it financially impossible to install such services, perhaps an overland collector system may have to be considered. In any event, a severe pollution potential presently exists in the community and immediate action is required, in the form of communal services, to alleviate this condition. In the meantime, the onus is on the individual homeowner to ensure that

his own waste disposal system is operating properly and not contributing to contamination of the ground and surface waters.

7. SUMMARY AND CONCLUSIONS

During the summer of 1969, a pollution survey of the community of Tobermory was carried out with the aid of the Wiarton office of the Bruce County Health Unit.

The results of this survey indicated that the summer boating activities in the Little and Big Tub Harbours, as well as the home sewage disposal practices, are polluting the waters of Lake Huron. The overburden in the area is unsuitable for septic tank and tile field systems because a suitable soil material for the proper operation of a tile field is not present. In many cases, such material is hauled in and the bed is constructed. This practice should be discouraged since the effluent rapidly trickles through the bed and flows along the rock surface to enter either the surface or groundwater.

The installation of communal water and sewage distribution systems as well as the proper enforcement of the new OWRC boating regulations will greatly reduce pollution of the surface and groundwaters in the Tobermory area.

8. RECOMMENDATIONS

1. Communal water and sewage treatment facilities should be installed and treated Lake Huron water should be used as the source of supply.

2. An official plan of the area should be developed and implemented in accordance with the findings of this survey.

3. All surface water supplies presently in use should be disinfected prior to consumption.

APPENDIX A

COMMUNITY OF TOBERMORY

TABLE NO. 1 - BACTERIOLOGICAL ANALYSES

TABLE NO. 2 - CHEMICAL ANALYSES

TABLE NO. 1

COMMUNITY OF TOBERMORY

- Bacteriological Analyses -

Tobermory Bay

<u>Sample No.</u>	<u>Coliform Organisms per 100 ml.</u>	
	<u>Total</u>	<u>Faecal</u>
1	40	0
2	20	0
3	65	12
4	85	4
5	40	2
6	10	0
7	175	32
8	130	20
9	1,800	34
10	900	126
11	340	200
12	200	108
13	1,000	230
14	400	40
15	1,500	100
16	1,400	200
17	700	700
18	200	42
19	600	100
20	4,800	2,400
21	400	100
22	2,300	1,300
23	2,400	200
24	2,100	900
25	2,900	620
26	700	200
27	11,200	100
28	2,500,000	900
29	0	0
30	Broken	Broken
31	4,500	2
32	2,400	76
33	100	2

TABLE NO. 1 (cont'd)

<u>Sample No.</u>	<u>Coliform Organisms per 100 ml.</u>	
	<u>Total</u>	<u>Faecal</u>
34	375	40
35	500	68
36	1,400	76
37	45	0
38	500	0
39	700	4
40	4	0
41	5	0
42	5	0
43	4	0
44	5	0
45	15	0
46	10	2
47	40	6
48	220	0
49	5	0
50	10	0
51	0	0
52	30	0
53	15	8
54	50	0
55	25	2
56	28	28
57	160	12
58	120	22
59	225	32
60	370	90
61	90	24
62	55	2
63	40	2
64	10,000	0

TABLE NO. 2
COMMUNITY OF TOBERMORY

- Chemical Analyses -

Tobermory Bay

<u>Source</u>	<u>5-Day BOD</u>	<u>Total</u>	<u>SOLIDS Susp.</u>	<u>Diss.</u>	<u>Phenols</u>	<u>Nitrate as N</u>
Little Tub	1.2	160	5	155	0	0.15
Big Tub	0.6	180	5	175	0	0.11

APPENDIX 4 - 21

BACTERIOLOGICAL AND CHEMICAL ANALYSES

	<u>PAGE</u>
1. TOWNSHIP OF ALBEMARLE	212
2. TOWNSHIP OF AMABEL	222
3. TOWNSHIP OF BRUCE	230
4. TOWNSHIP OF EASTNOR	235
5. TOWNSHIP OF HURON	244
6. TOWNSHIP OF KINCARDINE	252
7. TOWNSHIP OF LINDSAY	260
8. TOWNSHIP OF SAUGEEN	267
9. TOWNSHIP OF ST. EDMUNDS	277

* See Appendix 23 for significance and explanation of parameters.

APPENDIX 4

TOWNSHIP OF ALBEMARLE

- Bacteriological Analyses -

Table 1	-	Colpoys Bay
Table 2	-	Red Bay
Table 3	-	Berford Lake
Table 4	-	Howdenvale
Table 5	-	West Shore
Table 6	-	East Shore
Table 7	-	Boat Survey

TABLE No. 1

Albemarle Township - Colpoys Bay

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
July 1/69	1	0	0
"	2	100	0
"	3	0	0
"	4	5	0
"	5	5	0
"	6	0	0
"	7	0	0
"	8	0	0
"	9	195	2
"	10	0	0
"	11	15	0
"	12	200	0
"	13	20	0
"	14	4	0
"	15	40	4
"	16	400	0
"	17	500	0
"	18	600	12
"	19	Broken	
"	20		2
"	21	3000	400
"	22	1300	16
"	23	100	0
"	24	10	0
"	25	35	0
"	26	5	0
"	27	20	2
"	28	15	0
"	29	8	0
"	30	100	0
"	31	100	8
"	32	300	8
July 1/69	33	4	2
"	34	800	60
"	35	30	0
"	36	0	0
"	37	16	0
"	38	10	0
"	39	10	0
"	40	40	0
"	41	5	0

TABLE No. 2
Albemarle Township - Red Bay

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 11/69	1	8	2
"	2	30	30
"	3	40	16
"	4	70	6
"	5	30	10
"	6	30	30
"	7	20	20
"	8	140	10
"	9	70	10
"	10	20	18
"	11	30	30
"	12	100	20
"	13	2600	100
"	14	10	10
"	15	10	10
"	16	1400	70

TABLE No. 3

Albemarle Township - Berford Lake

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 11/69	1	360	250
"	2	180	120
"	3	510	100
"	4	2600	300
"	5	20	10
"	6	0	0
"	7	80	8
"	8	100	100
"	9	6	4
"	10	20	20
"	11	20	6
"	12	320	20
"	13	40	0
"	14	4	0
"	15	26	8
"	16	20	0
"	17	20	0
"	18	110	10
"	19	26	26
"	20	12	8
"	21	20	2
"	22	8	2
"	23	120	120
"	24	260	30
"	25	170	0

TABLE No. 4

Albemarle Township - Howdenvale

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 10/69	1	160	6
"	2	40	0
"	3	40	14
"	4	150	20
"	5	80	20
"	6	30	30
"	7	4	4
"	8	30	0
"	9	4	0
"	10	30	0

TABLE No. 5

Albemarle Township - West Shore

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 29/69	AL-1-W	Drilled Well	None	80 ⁺	80 ⁺
"	AL-2-W	Drilled Well	None	0	0
"	AL-3-W	Drilled Well	None	0	0
July 30/69	AL-4-W	Drilled Well	None	4	0
"	AL-5-W	Drilled Well	None	0	0
"	AL-6-W	Artesian Well	None	0	0
"	AL-7-W	Drilled Well	None	0	0
"	AL-8-W	Drilled Well	None	0	0
"	AL-9-W	Drilled Well	None	0	0

TABLE No. 6

Albemarle Township - East Shore

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 29/69	AL-1-E	Lake	None	0	0
"	AL-2-E	Lake	None	0	0
"	AL-3-E	Dug Well	None	0	0
"	AL-4-E	Lake	None	14	12
"	AL-5-E	Lake	None	0	0
"	AL-6-E	Lake	None	0	0
"	AL-7-E	Spring	None	80 ⁺	80 ⁺
"	AL-8-E	Lake	None	10	10
"	AL-9-E	Lake	None	28	6
"	AL-10-E	Lake	None	52	14
"	AL-11-E	Lake	None	0	0
"	AL-12-E	Lake	None	0	0
"	AL-13-E	Lake	None	4	4
"	AL-14-E	Drilled Lake	None	80 ⁺	80 ⁺
"	AL-15-E	Dug Well	None	80 ⁺	80 ⁺
"	AL-16-E	Lake	None	4	4
"	AL-17-E	Lake	None	0	0
"	AL-18-E	Dug Well	None	28	28
"	AL-19-E	Lake	None	2	0
"	AL-20-E	Dug Well	Purifier	20	14
"	AL-21-E	Dug Well	None	80 ⁺	80 ⁺
"	AL-22-E	Dug Well	None	0	0
"	AL-23-E	Dug Well	None	4	2
"	AL-24-E	Spring	None	0	0
"	AL-25-E	Dug Well	None	80 ⁺	20
"	AL-26-E	No Information		24	16

TABLE No. 7

Albemarle Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliform</u>	<u>Total Coliform</u>	<u>Distance From Shore</u>
Aug. 13/69	311	0	4	1500'
"	312	0	8	1200'
"	313	0	12	500'
"	314	0	4	900'
"	315	0	4	400'
"	316	0	2	200'
"	317	0	2	300'
"	318	2	2	300'
"	319	4	8	300'
"	320	4	12	100'
Aug. 19/69	445	16	12	300'
"	446	0	16	300'
"	447	14	2	300'
"	448	-	124	300'
"	449	0	4	300'
"	450	10	0	1000'
"	451	66	22	-
"	452	10	18	500'

APPENDIX 5

TOWNSHIP OF ALBEMARLE

- Chemical Analyses -

ALBEMARLE TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Lake Water</u>								
Colpoys Bay	98	79	0.20	6	8.7	5	2	4
<u>Drilled Wells</u>								
Evergreen Lodge	153	245	0.35	21	7.6	<5	1	50
Howdenvale	341	302	1.5	11	7.3	80	4	-
Red Bay	270	257	0.80	5	7.8	45	6	-
Little Red Bay	221	214	0.55	5	7.8	35	4	-
Wildwood Lodge	164	237	0.15	9	7.8	-	-	-
Wildwood Lodge	261	244	0.55	2	7.5	-	-	-
<u>Dug Wells</u>								
Hope Bay	324	312	0.10	2	7.2	15	19	8

APPENDIX 6

TOWNSHIP OF AMABEL

- Bacteriological Analyses -

Table 1	-	Oliphant
Table 2	-	Southampton to Oliphant
Table 3	-	Boat Survey

TABLE No. 1

Amabel Township - Oliphant

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
June 18/69	1	25	8
"	2	76	76
"	3	0	0
"	4	10	4
"	5	235	2
"	6	10	0
"	7	85	26
"	8	35	8
"	9	0	0
"	10	120	30
"	11	85	6
"	12	85	20
"	13	85	8
"	14	90	8
"	15	45	8
"	16	315	2
"	17	18	18
"	18	30	10
"	19	5	2
"	20	15	10
"	21	2	2
"	22	5	0
"	23	25	8
"	24	4	4
"	25	30	10
"	26	30	10
"	27	1900	1200
"	28	30	2
June 24/69	1	155	58
"	2	120	62
"	3	220	98
"	4	130	36
"	5	190	34
"	6	50	32
"	7	70	20
"	8	95	14
Aug. 12/69	1	10	0
"	2	0	0
"	3	20	0
"	4	25	10
"	5	5	2
"	6	10	4
"	7	15	12
"	8	70	32

TABLE No. 2

Southampton - Oliphant

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
Aug. 1/69	AM-1	Drilled Well	None	0	0
"	AM-2	Drilled Well	None	32	20
"	AM-3	Drilled Well	None	40	2
"	AM-4	Drilled Well	None	0	0
"	AM-5	Spring	None	2	0
"	AM-6	Drilled Well	None	80 ⁺	80 ⁺
"	AM-7	Drilled Well	None	0	0
"	AM-8	Drilled Well	None	0	0
"	AM-9	Drilled Well	None	80 ⁺	80 ⁺
"	AM-10	Drilled Well	None	0	0
"	AM-11	Drilled Well	None	10	6
"	AM-12	Drilled Well	None	0	0
"	AM-13	Sandpoint	None	80 ⁺	80 ⁺
"	AM-14	Drilled Well	None	0	0
"	AM-15	Dug Well	None	20	20
"	AM-16	Drilled Well	None	4	0
"	AM-17	Drilled Well	None	0	0
July 29/69	AM-1-W	Southampton WW	None	0	0
"	AM-2-W	Southampton WW	None	0	0
"	AM-3-W	Southampton WW	None	0	0
"	AM-4-W	Southampton WW	None	0	0
"	AM-5-W	Dug Well	None	0	0
"	AM-6-W	Lake	None	20	10*
"	AM-7-W	Lake	None	100	100*
"	AM-8-W	Dug Well	None	20	6*
"	AM-9-W	Lake	None	30	0*
"	AM-10-W	Lake	Filt.	0	0
"	AM-11-W	Lake	None	40	40*
"	AM-12-W	Lake	None	40	14*
"	AM-13-W	Drilled Well	None	80 ⁺	0
"	AM-14-W	Lake	Chlor.	28	0
"	AM-15-W	Lake	None	10	4
"	AM-16-W	Lake	None	10	10*
"	AM-17-W	Lake	None	40	2*
"	AM-18-W	Dug Well	Filt.	0	0
"	AM-19-W	Dug Well	None	1300	160*
July 30/69	AM-30-W	Lake	Chlor. & Filt.	0	0
"	AM-31-W	Sandpoint	None	2	0
"	AM-32-W	Sandpoint	None	0	0
"	AM-33-W	Sandpoint	None	0	0
"	AM-34-W	Sandpoint	None	0	0
"	AM-35-W	Sandpoint	None	0	0
"	AM-36-W	Lake	Chlor.	80 ⁺	17

TABLE NO. 2 - cont'd.

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 30/69	AM-37-W	Dug Well	None	22	2
"	AM-38-W	Drilled Well	None	2	2
"	AM-39-W	Dug Well	None	80 ⁺	80 ⁺
"	AM-40-W	Drilled Well	None	0	0
July 31/69	AM-41-W	Sandpoint	None	0	0
"	AM-42-W	Sandpoint	None	0	0
"	AM-43-W	Sandpoint	None	2	0
"	AM-44-W	Sandpoint	None	4	0
"	AM-45-W	Sandpoint	None	80 ⁺	80 ⁺
"	AM-46-W	Sandpoint	None	14	0
"	AM-47-W	Sandpoint	None	8	0
"	AM-48-W	Sandpoint	None	2	0
"	AM-49-W	No Sample Received			
"	AM-50-W	Sandpoint	None	0	0
"	AM-51-W	Sandpoint	None	0	0
"	AM-52-W	Sandpoint	None	0	0
"	AM-53-W	Sandpoint	None	0	0
"	AM-54-W	Sandpoint	None	0	0
"	AM-55-W	Sandpoint	None	4	0
"	AM-56-W	Sandpoint	None	0	0
"	AM-57-W	Sandpoint	None	0	0
"	AM-58-W	Sandpoint	None	54	0
"	AM-59-W	Sandpoint	Chlor.	0	0
"	AM-60-W	Sandpoint	Chlor.	0	0
"	AM-61-W	Sandpoint	None	0	0
"	AM-62-W	No Sample Received			
"	AM-63-W	Sandpoint	Chlor.	0	0
"	AM-64-W	Sandpoint	Chlor.	0	0
"	AM-65-W	Sandpoint	None	0	0
"	AM-66-W	Sandpoint	None	0	0
"	AM-67-W	Sandpoint	None	0	0
"	AM-68-W	Sandpoint	None	0	0
"	AM-69-W	Sandpoint	None	0	0
"	AM-70-W	Sandpoint	None	0	0
"	AM-71-W	Sandpoint	None	24	0
"	AM-72-W	Sandpoint	None	22	0
"	AM-73-W	Sandpoint	None	0	0
"	AM-74-W	Sandpoint	None	0	0
Aug. 1/69	AM-75-W	Sandpoint	None	0	0
"	AM-76-W	Sandpoint	None	0	0
"	AM-77-W	Drilled Well	None	0	0
"	AM-78-W	Drilled Well	None	0	0
"	AM-79-W	Sandpoint	None	0	0
"	AM-80-W	Drilled Well	None	0	0
"	AM-81-W	Drilled Well	None	0	0
"	AM-82-W	Drilled Well	None	4	0

TABLE No. 2 - cont'd.

Date	Sample No.	Source	Treatment	Total	Faecal
Aug. 5/69	AM-83-W	Sandpoint	None	0	0
"	AM-84-W	Sandpoint	None	0	0
"	AM-85-W	Sandpoint	None	0	0
"	AM-86-W	Sandpoint	None	0	0
"	AM-87-W	Sandpoint	None	0	0
"	AM-88-W	Sandpoint	None	0	0
"	AM-89-W	Creek	None	100,000	20,000*
"	AM-90-W	Sandpoint	None	0	0
"	AM-91-W	Sample Bottle Broken			
"	AM-92-W	Sandpoint	None	0	0
"	AM-93-W	Drilled Well	None	0	0
"	AM-94-W	Drilled Well	None	0	0
"	AM-95-W	Sandpoint	None	24	0
"	AM-96-W	Dug Well	None	80 ⁺	80 ⁺
"	AM-97-W	Sandpoint	None	20	0
"	AM-98-W	Sample Bottle Broken			
"	AM-99-W	Sandpoint	None	0	0
Aug. 6/69	AM-100-W	Ponding at Washroom	None	20,000	12,000*
"	AM-101-W	Ponding at Washroom	None	14,000	13,000*
"	AM-102-W	Lake	None	110	30*
"	AM-103-W	River	None	340	90*
"	AM-104-W	Sandpoint	None	0	0
"	AM-105-W	River	None	330	20*
"	AM-106-W	Sandpoint	None	0	0
"	AM-107-W	Drilled Well	None	16	10
"	AM-108-W	Lake	Chlor.	2	0
"	AM-109-W	Lake	None	190	30*
"	AM-110-W	Lake	Chlor.	0	0
"	AM-111-W	Drilled Well	None	80 ⁺	0
"	AM-112-W	Drilled Well	None	2	0
"	AM-113-W	Drilled Well	None	2	0
"	AM-114-W	Drilled Well	None	0	0
"	AM-115-W	Lake	None	160	10
"	AM-116-W	Lake	None	100	10
"	AM-117-W	Lake	None	50	50
"	AM-118-W	Drainage Ditch	None	17,000	8,000
"	AM-119-W	Drainage Ditch	None	42,000	4,000
A	AM-120-W	Storm Sewer from Main Street	None	460	50

*Not Used for Drinking

TABLE No. 3

Amabel Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliforms</u>	<u>Total Coliforms</u>	<u>Distance From Shore</u>
Aug. 12/69	277	0	8	2000'
"	278	0	0	2000'
"	279	4	16	2000'
"	280	2	18	800'
"	281	4	14	1000'
"	282	0	20	250'
"	283	0	30	300'
"	284	2	94	250'
"	285	2	18	300'
"	286	2	30	300'
"	287	20	130	400'
"	288	6	114	800'
"	289	0	2	450'
"	290	4	0	350'
"	291	8	0	250'
"	292	18	12	250'
"	293	0	0	250'
"	294	0	2	300'
"	295	0	0	200'
"	296	2	0	225'
"	297	2	2	300'
"	298	0	0	300'
"	299	0	0	300'
"	300	2	8	325'
"	301	0	4	300'
"	302	22	-	10'
"	303	0	580	10'
"	304	22	540	10'
"	305	4	220	20'
"	306	0	20	500'
"	307	0	0	225'
"	308	2	0	100'
"	309	2	4	300'
"	310	12	44	50'

APPENDIX 7

TOWNSHIP OF AMABEL

- Chemical Analyses -

AMABEL TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃</u>	<u>Alkalinity as CaCO₃</u>	<u>Iron as Fe</u>	<u>Chloride as Cl</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols</u>
<u>Lake Water</u>								
McKenzie Lonely Island	122	107	0.05	6	8.1	5	4	-
S. Sauble	140	122	0.10	24	7.5	<5	2	10
<u>Drilled Wells</u>								
N. Sauble	114	132	0.10	53	7.7	-	-	15
Chesley Lake	228	232	0.50	2	7.7	5	6	-
<u>Sandpoints</u>								
Sauble Beach	231	223	0.25	6	7.5	5	1	12
N. Sauble	266	241	2.6	19	7.2	90	4	6

APPENDIX 8

TOWNSHIP OF BRUCE

- Bacteriological Analyses -

Table 1	-	Bruce Township Shoreline and Vicinity
Table 2	-	Boat Survey

TABLE No. 1

Bruce Township - Shoreline and Vicinity

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 30/69	B-33	Dug Well	None	0	-*
"	B-34	Dug Well	None	0	-*
"	B-35	Dug Well	None	92	-
"	B-36	Dug Well	None	10	-
"	B-37	Drilled Well	None	0	-
"	B-38	Dug Well	None	0	-
July 31/69	B-39	Dug Well	None	26	0
"	B-40	Dug Well	None	6	6
"	B-41	Dug Well	None	0	0
"	B-42	Sandpoint	None	80 ⁺	0
"	B-43	Drilled Well	None	8	0
"	B-44	Drilled Well	None	0	0
"	B-45	Drilled Well	None	16	0
"	B-46	Dug Well	None	40	0
"	B-47	Drilled Well	None	0	0
"	B-48	Drilled Well	None	0	0
"	B-49	Drilled Well	None	0	0
"	B-50	Drilled Well	None	0	0
"	B-51	Spring	None	0	0
"	B-52	Drilled Well	None	0	0
"	B-53	Sandpoint	None	0	0
"	B-54	Sandpoint	None	0	0
"	B-55	Drilled Well	None	0	0
"	B-56	Drilled Well	None	0	0
"	B-57	Drilled Well	None	2	0
"	B-58	Drilled Well	None	0	0

* Not Used For Drinking

TABLE No. 2

Bruce Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliforms</u>	<u>Total Coliforms</u>	<u>Distance From Shore</u>
Aug. 11/69	246	0	0	175'
"	247	4	6	250'
"	248	0	10	2000'
"	249	0	16	2000'
"	250	0	0	1500'
"	251	0	6	2500'
"	252	0	2	500'
"	253	0	6	2000'
"	254	4	0	2000'
"	255	0	6	2000'
"	256	0	0	3000'
"	257	0	0	3000'
"	258	0	0	-
"	259	0	0	2000'

APPENDIX 9

TOWNSHIP OF BRUCE

- Chemical Analyses -

BRUCE TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Lake Water</u>								
Myles Bay	106	86	0.15	6	8.0	5	2	-
Myles Bay	209	167	0.35	8	8.0	50	6	-
Myles Bay	281	272	5.0	1	7.6	60	40	-
Douglas Point	93	82	0.20	7	8.4	<5	3	-
<u>Drilled Wells</u>								
10 Conc.	303	103	0.15	5	7.9	<5	1	4
Inverhuron	280	209	0.30	5	7.5	<5	2	3
Gee WW	220	188	0.35	3	7.4	<5	2	3
Inverhuron	414	152	0.30	7	7.7	5	3	120
<u>Dug Well</u>								
Baie du Dore	293	264	0.05	2	7.3	20	2	8

APPENDIX 10

TOWNSHIP OF EASTNOR

- Bacteriological Analyses -

Table 1	-	Pike Bay
Table 2	-	East Shoreline
Table 3	-	West Shoreline
Table 4	-	Boat Samples

TABLE No. 1

Eastnor Township - Pike Bay

<u>Date</u>	<u>Sample No.</u>	<u>Coliform Bacteria per 100 ml</u>	
		<u>Total</u>	<u>Faecal</u>
Aug. 20/69	1	5	0
"	2	50	10
"	3	6	6
"	4	6	6
"	5	4	4
"	6	2	0
"	7	5	0
"	8	12	12
"	9	4	4
"	10	0	0
"	11	5	0
"	12	10	4
"	13	5	0
"	14	4	0
"	15	2	2
"	16	2	2
"	17	0	0
"	18	0	0
"	19	0	0
"	20	10	0
"	21	0	0
"	22	2	2

TABLE No. 1 - Cont'd.

<u>Date</u>	<u>Sample No.</u>	<u>Coliform Bacteria per 100 ml</u>	
		<u>Total</u>	<u>Faecal</u>
Aug. 20/69	23	0	0
"	24	4	2
"	25	0	0
"	26	10	0

TABLE No. 2

Eastnor Township - East Shore Line

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 30/69	E-2-E	Lake	None	100	100
"	E-2-E	Lake	None	80 ⁺	80 ⁺
"	E-3-E	Drilled Well	None	80 ⁺	24
"	E-4-E	Lake	None	4	4
"	E-5-E	Lake	None	80 ⁺	80 ⁺
"	E-6-E	Lake	None	0	0
"	E-7-E	Dug Well	None	42	22
"	E-8-E	Dug Well	None	80 ⁺	80 ⁺
"	E-9-E	Spring	None	80 ⁺	72
"	E-10-E	Dug Well	None	0	0
"	E-11-E	Drilled Well	None	44	18
"	E-12-E	Lake	None	0	0
July 31/69	E-13-e	Lake	None	36	12
"	E-14-E	Lake	None	2	0
"	E-15-E	Lake	None	4	2
"	E-16-E	Lake	None	0	0
"	E-17-E	Spring	None	0	0
"	E-18-E	Spring	None	2	0
"	E-19-E	Spring	None	62	6
"	E-20-E	Drilled Well	None	0	0
"	E-21-E	Lake	None	0	0
"	E-22-E	Drilled Well	None	80 ⁺	80 ⁺
"	E-23-E	Drilled Well	None	80 ⁺	80 ⁺
"	E-24-E	Dug Well	None	80 ⁺	6
"	E-25-E	Drilled Well	None	0	0
"	E-26-E	Drilled Well	None	80 ⁺	80 ⁺
"	E-27-E	Lake	None	36	6
Aug. 5/69	E-28-E	Lake	None	0	0
"	E-29-E	Lake	None	0	0
"	E-30-E	Drilled Well	None	0	0
"	E-31-E	Lake	None	0	0
"	E-32-E	Drilled Well	None	0	0

TABLE No. 3

Eastnor Township - West Shoreline

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 31/69	E-28-W	Lake	None	0	0
"	E-29-W	Drilled Well	None	20	14
"	E-30-W	Lake	None	300	170
"	E-31-W	Drilled Well	None	80	4
"	E-32-W	River Sample	None	460	60
"	E-33-W	Drilled Well	None	20	0
"	E-34-W	Drilled Well	None	26	2
"	E-35-W	Lake	None	1900	250
"	E-36-W	River	None	5300	400
Aug. 1/69	E-39-W	Lake	None	4	0
"	E-40-W	Drilled Well	None	6	2
"	E-41-W	Lake	None	260	220
"	E-42-W	Drilled Well	None	80 ⁺	80 ⁺
"	E-43-W	Drilled Well	None	0	0
"	E-44-W	Drilled Well	None	50	4*
"	E-17-W	Lake	None	18	18
"	E-18-W	Lake	None	74	64
"	E-19-W	Lake	None	140	140*
July 29/69	E-1-W	Drilled Well	None	0	0
"	E-10-W	Well	None	0	0
"	E-11-W	Well	None	4	4
"	E-12-W	Well	None	80	80
July 30/69	E-13-W	Lake	None	0	0
"	E-14-W	Lake	None	80	0
"	E-15-W	Well	None	36	4
"	E-16-W	Lake	None	80	32
"	E-20-W	Drilled Well	None	8	4
"	E-21-W	Lake	None	1400	200*
"	E-22-W	Drilled Well	None	16	0
"	E-23-W	Drilled Well	None	80 ⁺	80 ⁺
"	E-24-W	River	None	800	360*
"	E-25-W	Drilled Well	None	0	0
"	E-26-W	River	None	400	400*
July 31/69	E-27-W	Drilled Well	None	0	0
"	E-45-W	Creek	None	2600	100*
"	E-46-W	Lake	None	0	0

TABLE No. 3 - Cont'd.

Eastnor Township - West Shoreline

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
Aug. 6/69	E-47-W	Drilled Well	None	Broken	
"	E-48-W	Well	None	80 ⁺	80 ⁺
"	E-49-W	Drilled Well	None	0	0
"	E-50-W	Drilled Well	None	80	72
"	E-51-W	Drilled Well	None	0	0
"	E-52-W	Drilled Well	None	0	0
"	E-53-W	Lake	None	0	0
"	E-54-W	Drilled Well	None	0	0
"	E-55-W	Drilled Well	None	10	0
"	E-56-W	Lake	None	0	0
"	E-57-W	Drilled Well	None	80 ⁺	0
"	E-58-W	Drilled Well	None	0	0
"	E-59-W	Drilled Well	None	8	4

*Not Drinking Water

TABLE No. 4

Eastnor Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliforms</u>	<u>Total Coliforms</u>	<u>Distance From Shore</u>
Aug. 13/69	321	0	26	200'
"	322	12	46	150'
"	323	2	30	150'
"	324	6	10	150'
"	325	2	10	500'
"	326	0	0	1000'
"	327	0	4	1800'
"	328	2	20	225'
"	329	4	14	150'
"	330	0	2	200'
"	331	0	62	150'
"	332	4	24	200'
"	333	2	156	400'
"	334	0	16	500'
Aug. 15/69	335	0	16	1000'
"	336	8	26	300'
"	337	90	390	100'
"	338	0	14	300'
Aug. 19/69	426	2	0	200'
"	427	-	-	200'
"	428	-	0	200'
"	429	2	0	200'
"	430	0	0	200'
"	431	0	0	200'
"	432	4	0	200'
"	433	0	0	300'
"	434	-	-	-
"	435	-	-	150'
"	436	6	0	1000'
"	437	26	0	300'
"	438	0	0	200'
"	439	-	-	200'
"	440	96	70	-
"	441	14	0	300'
"	442	0	0	500'

APPENDIX 11

TOWNSHIP OF EASTNOR

- Chemical Analyses -

EASTNOR TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Lake Water</u>								
Little Pike Bay	102	85	0.05	6	8.5	<5	2	-
Barrow Bay	224	198	0.25	4	8.3	35	4	10
Myles Bay	112	92	0.65	6	8.4	10	6	-
<u>Drilled Wells</u>								
Stokes Bay	440	292	0.20	6	7.5	25	3	8
<u>Dug Wells</u>								
Barrow Bay	271	250	0.05	3	7.6	<5	1	20

APPENDIX 12

TOWNSHIP OF HURON

- Bacteriological Analyses -

Table 1	-	Lurgan Beach
Table 2	-	Pt. Clark
Table 3	-	Pt. Clark
Table 4	-	Boiler Beach
Table 5	-	Boat Survey

TABLE No. 1

Huron Township - Lurgan Beach

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
June 25/69	1	570	356
"	2	370	144
"	3	50	18
"	4	40	0
"	5	200	0
"	6	155	0
"	7	20	0
"	8	5	4
"	9	60	0
"	10	10	0
"	11	10	0
"	12	0	0

TABLE No. 2

Huron Township - Pt. Clark

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
July 8/69	1	60	16
"	2	45	0
"	3	10	8
"	4	5	4
"	5	5	4
"	6	35	0
"	7	0	0
"	8	0	0
"	9	0	0
"	10	0	0
"	11	5	0
"	12	70	18
"	13	0	0
"	14	10	4
"	15	5	2
"	16	0	0
"	17	45	0

TABLE No. 3

Huron Township - Pt. Clark

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 21/69	1	80	22
"	2	1300	78
"	3	100	32
"	4	130	78
"	5	70	0
"	6	50	30
"	7	40	40
"	8	20	20
"	9	20	18
"	10	22	22
"	11	700	12
"	12	130	112
"	13	125	40
"	14	25	16
"	15	20	8
"	16	30	22
"	17	18	18
"	18	30	22
"	19	20	14
"	20	35	26

TABLE No. 4

Huron Township - Boiler Beach

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 30/69	H-1	Spring	None	0	0
"	H-2	Spring	None	0	0
"	H-3	Spring	None	80 ⁺	58

TABLE No. 5

Huron Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliform</u>	<u>Total Coliform</u>	<u>Distance From Shore</u>
Aug. 6/69	200	0	104	300'
"	201	4	210	300'
"	202	0	42	300'
"	203	8	34	200'
"	204	28	52	200'
"	205	116	32	100'
"	206	0	2	1000'
"	207	0	2	1000'
"	208	0	24	1000'
"	209	0	14	1000'
"	210	0	0	1000'
"	211	0	0	1000'
"	212	0	2	1000'
"	213	0	0	1000'
"	214	0	0	1000'
"	215	0	0	1000'
"	216	0	0	1000'
"	217	0	16	1000'
"	218	4	0	1000'
"	219	4	2	1000'
"	220	0	2	1000'
"	221	0	0	1000'
"	222	0	0	1000'
"	223	0	2	1000'

APPENDIX 13

TOWNSHIP OF HURON

- Chemical Analyses -

HURON TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Drilled Wells</u>								
Smith WW	1130	155	0.05	91	7.2	-	-	-
Lurgan Beach	681	167	0.75	102	7.4	-	-	-
Pine River	1130	106	5.6	104	7.3	-	-	-
Yost WW	389	188	0.25	12	7.4	-	-	-
Bruce Beach	529	168	0.25	206	7.4	-	-	-
Tout's Grove WW	406	157	0.15	185	7.6	-	-	-
Boiler Beach	224	155	0.15	8	7.8	-	-	-
Munn WW	493	179	0.10	19	7.5	-	-	-
Ohleiser WW	280	180	0.60	39	7.7	-	-	-
Ackert WW	434	178	0.25	173	7.5	-	-	-
Rogers WW	290	177	0.95	61	7.6	-	-	-
Schiel WW	537	180	0.10	11	7.5	-	-	-

APPENDIX 14

TOWNSHIP OF KINCARDINE

- Bacteriological Analyses -

Table 1	-	Inverhuron Beach
Table 2	-	Dock and Beach Area
Table 3	-	Inverhuron Beach
Table 4	-	Shoreline and Vicinity
Table 5	-	Boat Survey

TABLE No. 1

Kincardine Township - Inverhuron Beach

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
June 24/69	1	15	2
"	2	5	0
"	3	130	0
"	4	20	0
"	5	15	0
"	6	3000	102
"	7	75	2
"	8	15	2
"	9	6	6
"	10	50	0
"	11	205	100
"	12	70	20

TABLE No. 2

Kincardine Township - Dock & Beach

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
June 24/69	1	300	6
"	2	800	4
"	3	210	16
"	4	1100	340
"	5	2700	560
"	6	3000	600
"	7	2700	620
"	8	2500	200
"	9	1100	52
"	10	1400	100
"	11	2100	440
"	12	3100	410
"	13	2500	300
"	14	2000	500
"	15	2400	400
"	16	900	96
"	17	160	8
"	18	40	0
"	19	130	2
"	20	110	2
"	21	105	4

TABLE No. 3

Kincardine Township - Inverhuron Beach

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
June 25/69	1	5	0
"	2	25	2
"	3	40	6
"	4	150	2
"	5	80	18
"	6	60	4
"	7	35	0
"	8	30	10
"	9	44	44
"	10	560	560
"	11	800	510
"	12	600	600
"	13	90	14
"	14	2000	36
"	15	55	2
"	16	15	2
"	17	15	10
"	18	5	2

TABLE No. 4

Kincardine Township - Shoreline & Vicinity

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 28/69	K-1	Sandpoint	None	2	0
"	K-2	Sandpoint	None	0	0
"	K-3	Sandpoint	None	0	0
"	K-4	Dug Well	None	0	0
"	K-5	Drilled Well	None	0	0
"	K-6	Drilled Well	None	0	0
"	K-7	Drilled Well	None	0	0
"	K-8	Drilled Well	None	0	0
"	K-9	Drilled Well	None	0	0
July 29/69	K-10	Drilled Well	None	0	0
"	K-11	Drilled Well	None	0	0
"	K-12	Dug Well	None	80 ⁺	80 ⁺
"	K-13	Drilled Well	None	0	0
"	K-14	Drilled Well	None	0	0
"	K-15	Drilled Well	None	0	0
"	K-16	Dug Well	None	0	0
"	K-17	Well	None	0	0

TABLE No. 5
Kincardine Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliforms</u>	<u>Total Coliforms</u>	<u>Distance From Shore</u>
Aug. 6/69	224	0	0	1000'
"	225	0	0	1000'
"	226	0	0	1000'
"	227	8	14	-
"	228	8	44	-
"	229	0	22	-
"	230	0	0	250'
"	231	0	0	800'
Aug. 11/69	232	0	180	500'
"	233	0	20	500'
"	234	4	18	1500'
"	235	0	6	500'
"	236	0	0	800'
"	237	0	8	1200'
"	238	0	6	1000'
"	239	0	0	1800'
"	240	0	2	2000'
"	241	0	0	2000'
"	242	0	4	1000'
"	243	0	2	1000'
"	244	0	4	800'
"	245	12	6	350'

APPENDIX 15

TOWNSHIP OF KINCARDINE

- Chemical Analyses -

KINCARDINE TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Drilled Wells</u>								
Birrell WW	272	234	0.25	2	7.5	<5	1	50
Edward's WW	228	198	0.10	3	7.7	-	-	-
Cedar Terraces WW	290	252	0.05	4	7.6	-	-	-
Lime Kiln Lodge	250	201	0.05	3	7.9	-	-	-

APPENDIX 16

TOWNSHIP OF LINDSAY

- Bacteriological Analyses -

Table 1	-	Miller Lake
Table 2	-	Dyer Bay
Table 3	-	West Shore Line
Table 4	-	Boat Survey

TABLE No. 1

Lindsay Township - Miller Lake

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 20/69	1	4	4
"	2	35	2
"	3	5	2
"	4	16	8
"	5	6	2
"	6	18	6
"	7	15	8
"	8	75	4
"	9	8	2
"	10	16	0
"	11	14	0
"	12	36	36
"	13	40	0
"	14	8	2
"	15	5	0
"	16	5	2
"	17	4200	6
"	18	5	2
"	19	25	0
"	20	40	0
"	21	10	0
"	22	2	2
"	23	25	0
"	24	2	2
"	25	10	4

TABLE No. 2

Lindsay Township - Dyer Bay

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
Aug. 5/69	L-1-E	Lake	None	0	0
"	L-2-E	Lake	None	0	0
"	L-3-E	Drilled Well	None	2	0
"	L-4-E	Drilled Well	None	80 ⁺	38
"	L-5-E	Lake	None	0	0
"	L-6-E	Drilled Well	None	80 ⁺	80 ⁺
"	L-7-E	Drilled Well	None	80 ⁺	80 ⁺
"	L-8-E	Drilled Well	None	0	0
"	L-9-E	Lake	None	0	0
"	L-10-E	Lake	None	0	0
"	L-11-E	Drilled Well	None	40	40

TABLE No. 3

Lindsay Township - West Shore

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 29/69	L-7-W	Lake	None	80 ⁺	80 ⁺
"	L-8-W	Harbour	None	0	0
"	L-9-W	Gauley Bay	None	0	0

TABLE No. 4

Lindsay Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliforms</u>	<u>Total Coliforms</u>	<u>Distance From Shore</u>
Aug. 15/69	339	4	30	200'
"	340	4	28	200'
"	341	0	4	200'
"	342	0	18	2500'
"	343	4	110	-
Aug. 19/69	415	-	-	300'
"	416	-	-	200'
"	417	4	2	200'
"	418	0	0	200'
"	419	4	0	200'
"	420	0	0	200'
"	421	2	0	200'
"	422	0	6	-
"	423	0	0	200'
"	424	0	0	300'
"	425	0	0	300'

APPENDIX 17

TOWNSHIP OF LINDSAY

- Chemical Analyses -

LINDSAY TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Lake Water</u>								
Gauley Bay	101	85	0.05	6	8.3	<5	2	-
French Harbour	100	84	0.10	6	8.2	<5	2	-
<u>Drilled Well</u>								
Dyer Bay	258	191	0.15	21	7.7	15	2	6

APPENDIX 18

TOWNSHIP OF SAUGEEN

- Bacteriological Analyses -

Table 1	-	Gobles Grove
Table 2	-	Miramichi Bay
Table 3	-	Southampton and Lakeshore North
Table 4	-	Port Elgin Harbour and Swimming Area
Table 5	-	Gobles Grove
Table 6	-	Lake Huron Shoreline
Table 7	-	Boat Survey

TABLE No. 1

Saugeen Township - Gobles Grove

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
June 16/69	1	10	0
"	2	5	0
"	3	5	0
"	4	0	0
"	5	50	10
"	6	20	20
"	7	0	0
"	8	40	0
"	9	0	0
"	10	0	0
"	11	0	0
"	12	0	0
"	13	60	6
"	14	40	4
"	15	0	0

TABLE No. 2

Saugeen Township - Miramichi Bay

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
July 2/69	1	400	16
"	2	110	30
"	3	150	94
"	4	50	32
"	5	300	20
"	6	100	0
"	7	20	6
"	8	55	4
"	9	85	18
"	10	600	58
"	11	300	44
"	12	40	12
"	13	100	14
"	14	30	8
"	15	100	20
"	16	150	4
"	17	200	8
"	18	220	220
"	19	1500	42

TABLE No. 3

Saugeen Township - Southampton & Lakeshore North

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 7/69	1	640	240
"	2	50	20
"	3	2200	700
"	4	100	90
"	5	600	300
"	6	1900	470
"	7	500	470
"	8	340	270
"	9	130	110
"	10	40	40
"	11	60	30
"	12	40	40
"	13	50	50
"	14	280	50
"	15	330	110
"	16	1200	210
"	17	130	40
"	18	100	20
"	19	210	200
"	20	200	90
"	21	60	30
"	22	460	460
"	23	900	900
"	24	5000	5000
"	25	100	100
"	26	350	350
"	27	790	790
"	28	2400	1800
"	29	830	550
"	30	1000	580
"	31	800	600
"	32	250	140
"	33	310	220
"	34	210	210
"	35	320	250
"	36	5300	600
"	37	120	120
"	38	530	420
"	39	380	360

TABLE No. 4

Saugeen Township - Port Elgin Harbour and Swimming Area

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 25/69	1	90,000,000	35,000,000
"	2	9,000	2,000
"	3	10,000	2,000
"	4	100,000	12,000
"	5	41,000	3,200
"	6	260	50
"	7	460	64
"	8	350	80
"	9	400	150
"	10	360	146
"	11	2,600	800
"	12	140	32
"	13	260	10
"	14	540	360
"	15	160	78
"	16	250	40
"	17	46,000	3,700
"	18	560	96
"	19	180	30
"	20	260	10
"	21	310	80
"	22	110	20
"	23	130	24
"	24	560	112
"	25	2,600	1,000
"	26	310	160
"	27	70	40
"	28	180	110
"	29	1,900	0
"	30	170	170

TABLE No. 5

Saugeen Township - Gobel's Grove

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 27/69	1	200	10
"	2	300	10
"	3	300	36
"	4	6	6
"	5	35	18
"	6	75	4
"	7	5	0
"	8	5400	8
"	9	5	4
"	10	50	0
"	11	25	4

TABLE No. 6

Saugeen Township - Lake Huron Shoreline

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 28/69	S-1	Drilled	None	0	0
"	S-2	Sandpoint	None	0	0
"	S-3	Sandpoint	None	0	0
"	S-4	Sandpoint	None	0	0
"	S-5	Sandpoint	None	2	0
"	S-6	Sandpoint	None	0	0
"	S-7	Sandpoint	None	0	0
"	S-8	Sandpoint	None	0	0
July 29/69	S-9	Dug Well	None	46	14
"	S-10	Sandpoint	None	0	0
"	S-11	Sandpoint	None	0	0
"	S-12	Sandpoint	None	0	0
"	S-13	Drilled Well	None	0	0
"	S-14	Sandpoint	None	0	0
"	S-15	Drilled Well	None	0	0
"	S-16	Sandpoint	None	0	0
July 30/69	S-17	Sandpoint	None	0	-
"	S-18	Sandpoint	None	0	-
"	S-19	Sandpoint	None	Broken	-
"	S-20	Sandpoint	None	0	-
"	S-21	Sandpoint	None	0	-
"	S-22	Sandpoint	None	2	-
"	S-23	Sandpoint	None	0	-
"	S-24	Sandpoint	None	56	-
"	S-25	Drilled Well	None	0	-
"	S-26	Sandpoint	None	0	-
"	S-27	Dug Well	None	120	-
"	S-28	Stream	None	138	0
"	S-29				
"	S-30	Drilled Well	None	0	-
"	S-31	Sandpoint	None	0	-
"	S-32	Dug Well	None	0	-

TABLE No. 7

Saugeen Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliform</u>	<u>Total Coliforms</u>	<u>Distance From Shore</u>
Aug. 11/69	260	0	2	1200'
"	261	0	0	1000'
"	262	0	4	1000'
"	263	4	2	2000'
"	264	0	4	1000'
"	265	20	12	1000'
"	266	20	24	2000'
Aug. 12/69	267	0	66	1000'
"	268	0	24	1400'
"	269	8	50	400'
"	270	4	44	400'
"	271	8	30	1300'
"	272	0	22	2200'
"	273	0	14	1100'
"	274	6	12	400'
"	275	0	10	500'
"	276	48	128	-

APPENDIX 19

TOWNSHIP OF SAUGEEN

- Chemical Analyses -

SAUGEEN TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Lake Water</u>								
Port Elgin	94	83	0.20	7	8.4	<5	1	-
Southampton	97	84	0.45	7	8.0	<5	3	-
<u>Drilled Well</u>								
Gobles Grove	1400	153	1.5	6	7.2	30	1	12
Fairway Park	298	282	0.25	22	7.2	<5	1	16
<u>Sandpoints</u>								
Miramichi Bay	260	230	0.45	3	7.4	35	3	25

APPENDIX 20

TOWNSHIP OF ST. EDMUNDS

- Bacteriological Analyses -

Table 1	-	Dorcas Bay
Table 2	-	Dorcas Bay Swimming Area
Table 3	-	Dunks Bay
Table 4	-	Shoreline East and West
Table 5	-	Boat Survey

TABLE No. 1

St. Edmunds Township - Dorcas Bay

<u>Date</u>	<u>Sample No.</u>	<u>Coliform Bacteria per 100 ml</u>	
		<u>Total</u>	<u>Faecal</u>
June 25/69	1	20	0
"	2	20	0
"	3	60	0
"	4	20	6
"	5	65	4
"	6	45	2
"	7	10	0
"	8	Broken	
"	9	2	2
"	10	0	0
"	11	5	0
"	12	20	0
"	13	10	0
"	14	0	0
"	15	10	8
"	16	5	0

TABLE No. 2

St. Edmunds Township - Dorcas Bay Swimming Area

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
Aug. 14/69	1	50	30
"	2	10	10
"	3	40	40
"	4	100	100
"	5	600	60
"	6	100	20
"	7	30	20
"	8	10	0
"	9	0	0
"	10	30	30
"	11	20	20
"	12	100	0
"	13	70	20
"	14	40	0
"	15	1400	380

TABLE No. 3

St. Edmunds Township - Dunks Bay

<u>Date</u>	<u>Sample No.</u>	<u>Total</u>	<u>Faecal</u>
June 25/69	1	20	0
"	2	80	0
"	3	370	0
"	4	2	2
"	5	0	0
"	6	0	0
"	7	0	0
"	8	0	0
"	9	0	0
"	10	0	0
"	11	5	0
"	12	0	0
"	13	0	0
"	14	0	0
"	15	20	0
"	16	0	0

TABLE No. 4

St. Edmunds Township - Shoreline East and West

<u>Date</u>	<u>Sample No.</u>	<u>Source</u>	<u>Treatment</u>	<u>Total</u>	<u>Faecal</u>
July 29/69	STE-2-W	Lake	None	110	30*
"	STE-3-W	Lake	None	160	20*
"	STE-4-W	Lake	None	160	20
"	STE-5-W	Lake	Charcoal Filt.	100	2*
"	STE-6-W	Drilled Well	None	4	0
"	STE-7-W	Lake	Filtered	Broken	
July 30/69	STE-8-W	Drilled Well	None	2	0
"	STE-9-W	Drilled Well	None	0	0
"	STE-10-W	Lake	None	0	0
"	STE-11-W	Lake	Chlorination	0	0
"	STE-12-W	Drilled Well	None	80 ⁺	0
"	STE-13-W	Drilled Well	None	0	0
"	STE-14-W	Lake	None	0	0
"	STE-15-W	Drilled Well	None	0	0
"	STE-16-W	Lake	None	80 ⁺	60
"	STE-17-W	Lake	None	10	0
Aug. 1/69	ST-18	Lake	None	60	20
"	ST-19	Lake	None	40	0
"	ST-20	Lake	None	12	2
"	ST-21	Lake	None	80 ⁺	80 ⁺
"	ST-22	Lake	None	14	0
July 29/69	S-1-W	Lake	None	80 ⁺	0
"	S-4-W	Lake	None	0	0
"	S-5-W	Lake	None	0	0
"	S-6-W	Drilled Well	None	24	12
July 28/69	STE-1-E	Lake	None	0	0*
July 29/69	STE-2-E	Lake	None	0	0
"	STE-2-E	Lake	None	0	0
"	STE-3-E	Lake	Chlorination	Broken	
"	STE-4-E	Not Stated		80 ⁺	80 ⁺
"	STE-10-E	Drilled Well	Chlorination	0	0

* Not For Drinking

TABLE No. 5

St. Edmunds Township - Boat Survey

<u>Date</u>	<u>Station</u>	<u>Faecal Coliforms</u>	<u>Total Coliforms</u>	<u>Distance From Shore</u>
Aug. 15/69	344	0	18	-
"	345	0	6	2500'
"	346	0	4	-
"	347	0	20	2500'
"	348	0	120	400'
"	349	4	8	3000'
"	350	0	12	250'
"	351	2	18	150'
"	352	0	10	375'
"	353	2	16	200'
"	354	0	6	-
"	355	0	4	350'
"	356	2	12	1000'
"	357	2	4	200'
"	358	0	16	100'
"	359	0	0	300'
Aug. 16/69	360	2	12	-
"	361	2	4	-
"	362	0	2	-
"	363	2	6	-
"	400	0	2	200'
"	401	0	0	200'
"	402	0	6	200'
"	403	196	96	100'
"	404	12	110	-
"	405	48	330	-
"	406	2	4	200'
"	407	8	12	200'
"	408	0	0	200'
"	409	0	6	50'
"	410	0	0	50'
Aug. 17/69	411	0	8	100'
"	412	0	0	450'
"	413	4	2	100'
"	414	0	0	300'

APPENDIX 21

TOWNSHIP OF ST. EDMUNDS

- Chemical Analyses -

ST. EDMUNDS TOWNSHIP

<u>Sample Description</u>	<u>Hardness as CaCO₃ (ppm)</u>	<u>Alkalinity as CaCO₃ (ppm)</u>	<u>Iron as Fe (ppm)</u>	<u>Chloride as Cl (ppm)</u>	<u>pH at Lab</u>	<u>Colour Units</u>	<u>Turbidity Units</u>	<u>Phenols (ppb)</u>
<u>Lake Water</u>								
Pine Tree Harbour	100	83	0.15	6	7.9	<5	2	6
Dorcos Bay	112	80	0.30	6	8.1	5	13	4
Tobermory Harbour	-	-	-	-	-	-	-	8
<u>Drilled Well</u>								
Tobermory	335	312	0.15	6	7.4	5	1	4

APPENDIX 22

SUGGESTED CONSTRUCTION TECHNIQUES

	<u>PAGE</u>
WATER SUPPLIES	
Dug Well	286
Bored Well	287
Drilled Well	288
Sandpoint	289
Spring Supply	290
SEPTIC TANK SYSTEM	291

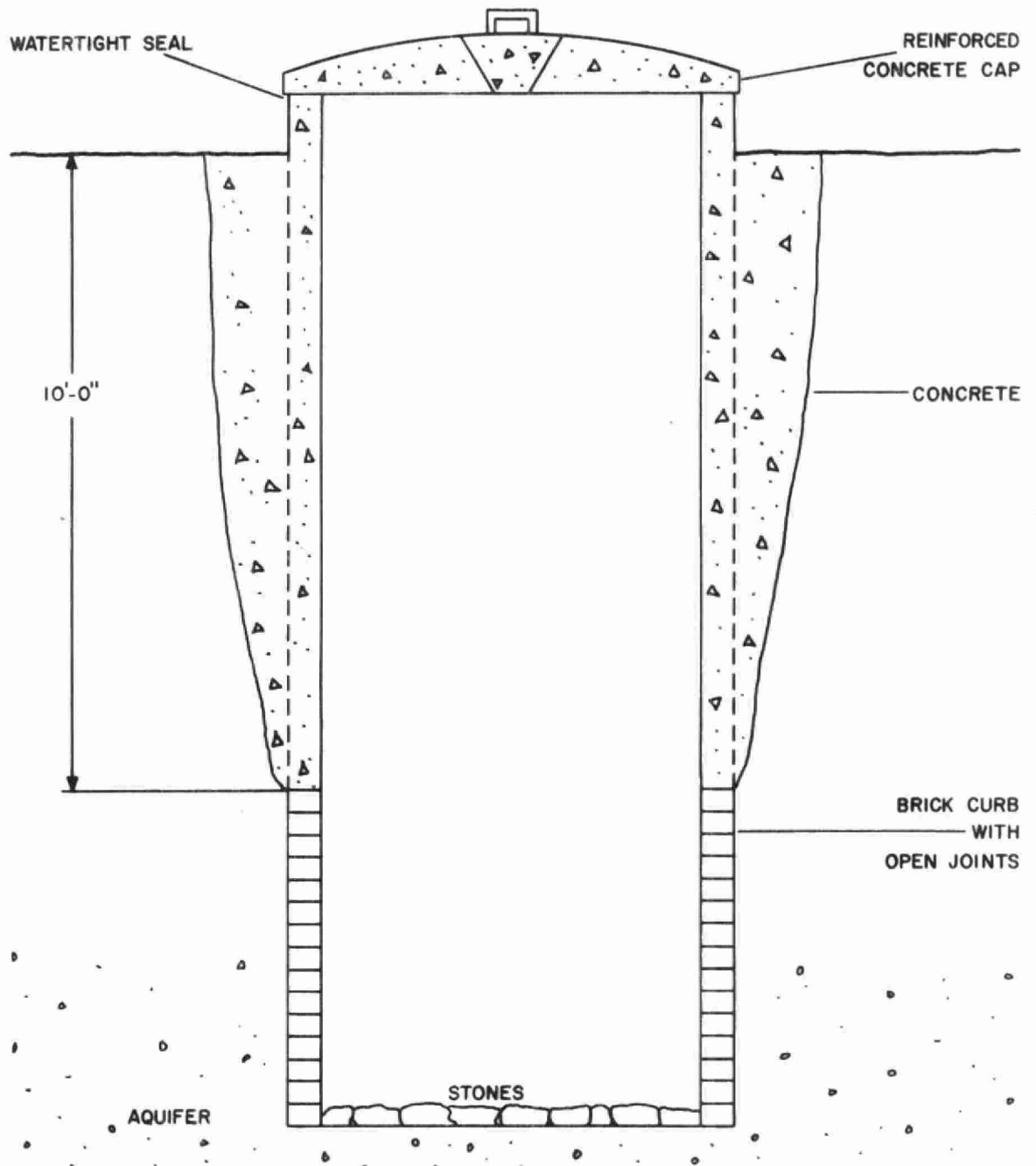
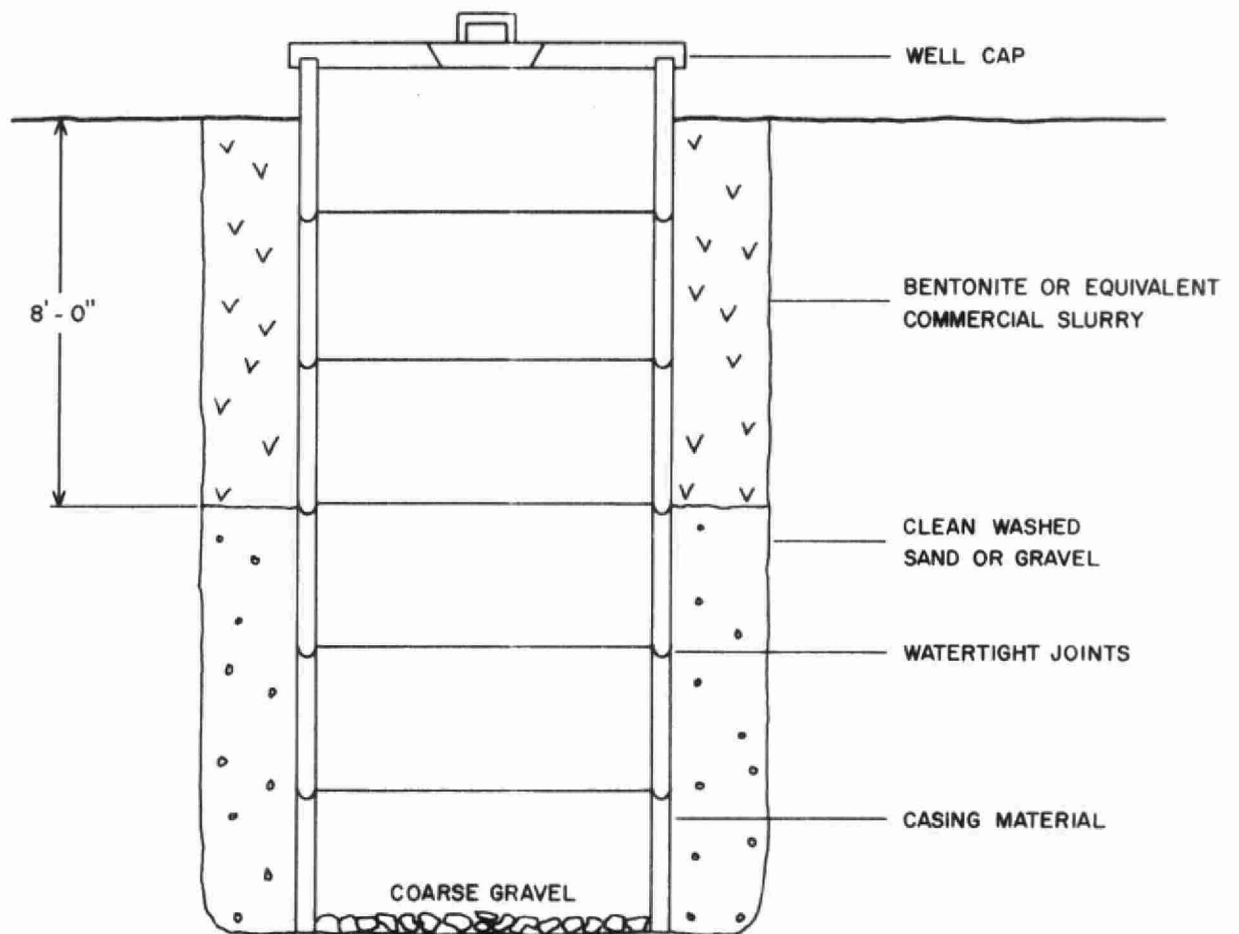


FIG. 1 - SUGGESTED CONSTRUCTION OF A DUG WELL



SUGGESTED CONSTRUCTION OF A BORED WELL DEEPER THAN EIGHT FEET

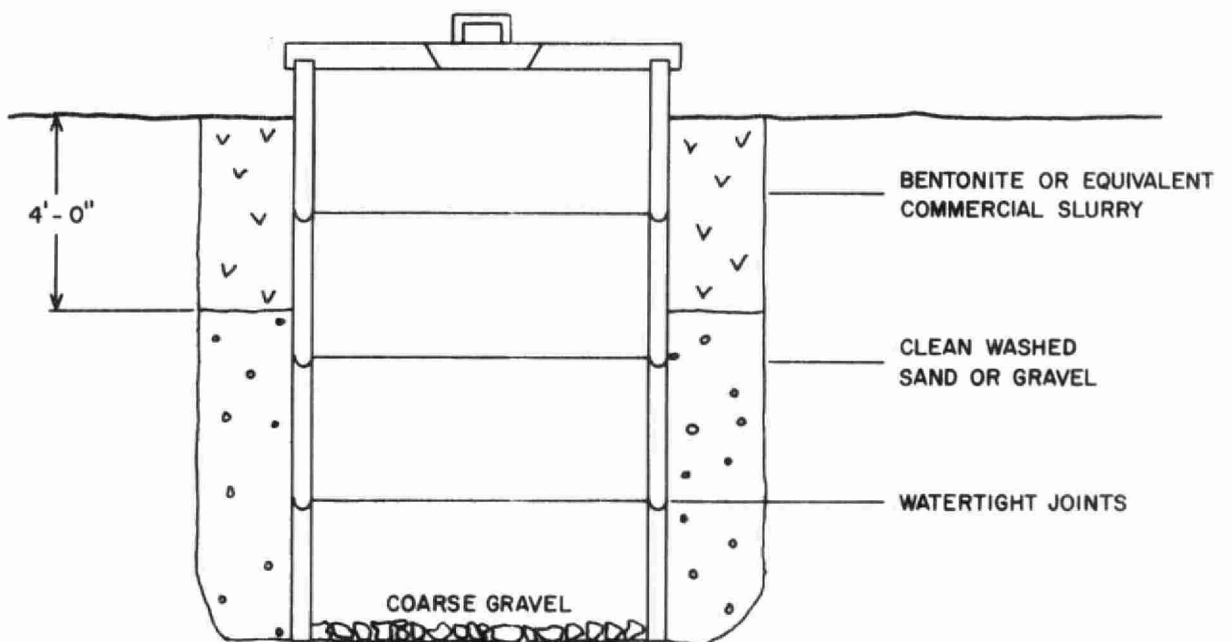


FIG. 2- SUGGESTED CONSTRUCTION OF A BORED WELL EIGHT FEET OR LESS

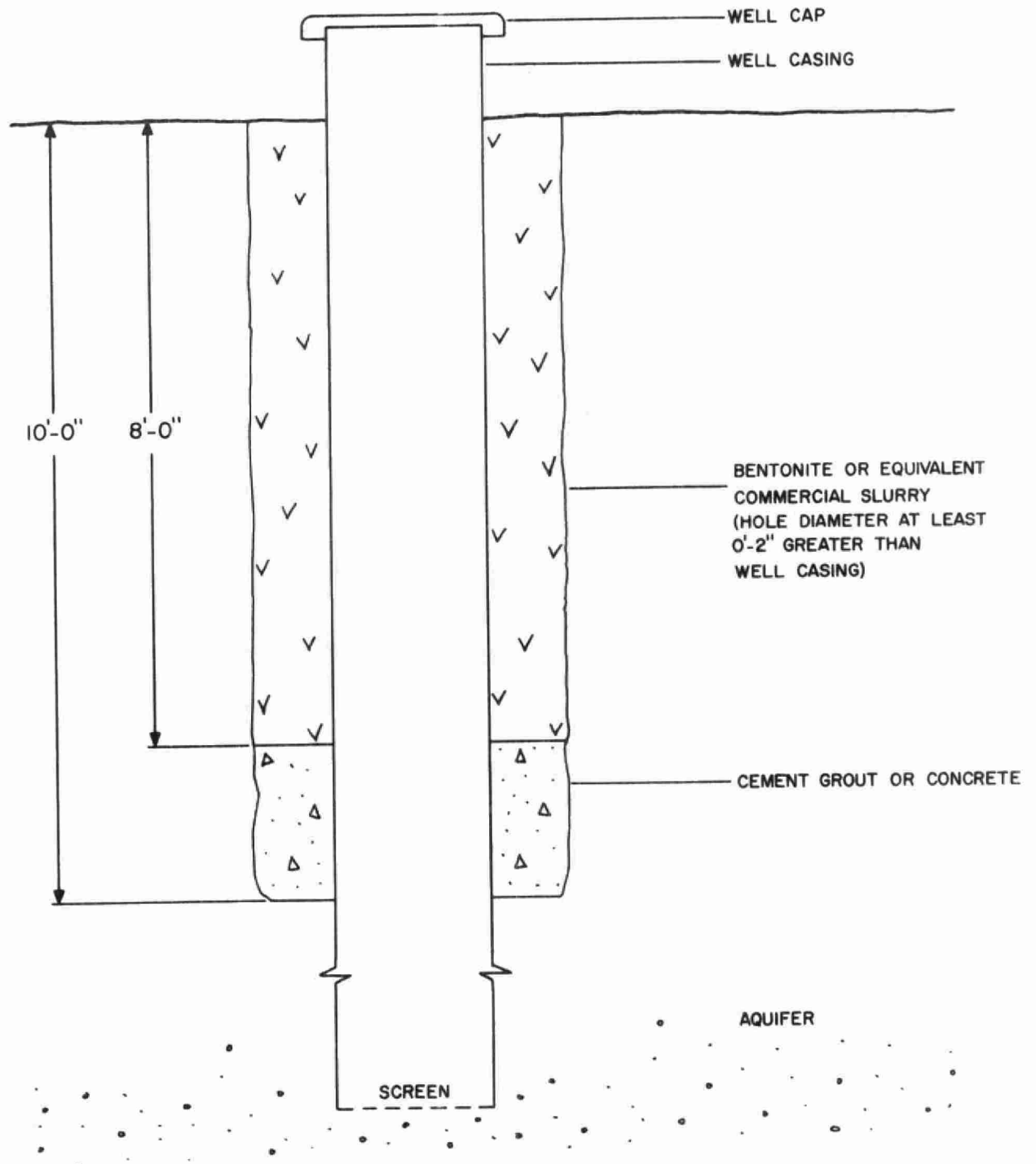


FIG. 3 - SUGGESTED CONSTRUCTION OF A DRILLED WELL

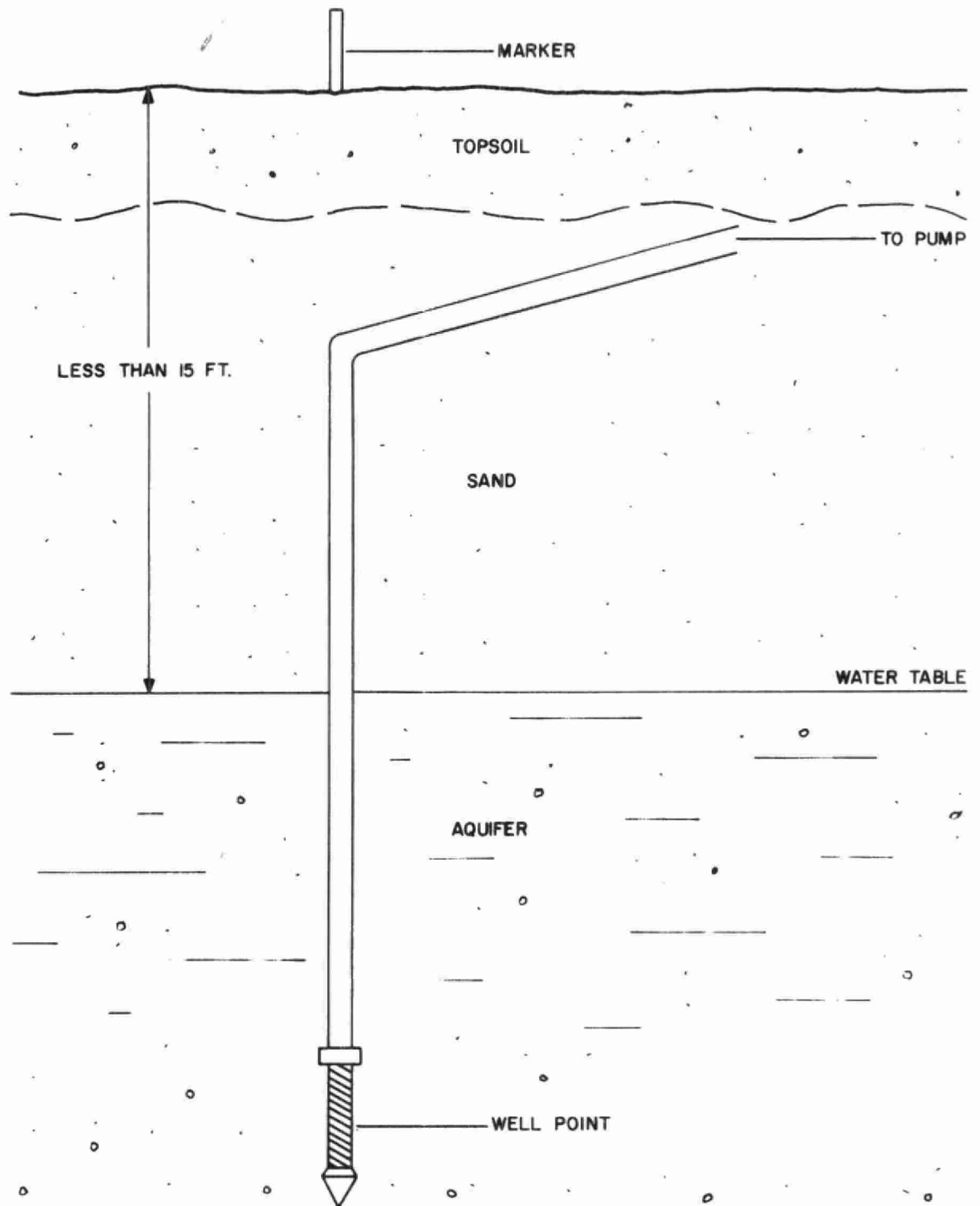


FIG. 4 - SUGGESTED CONSTRUCTION OF A SAND POINT

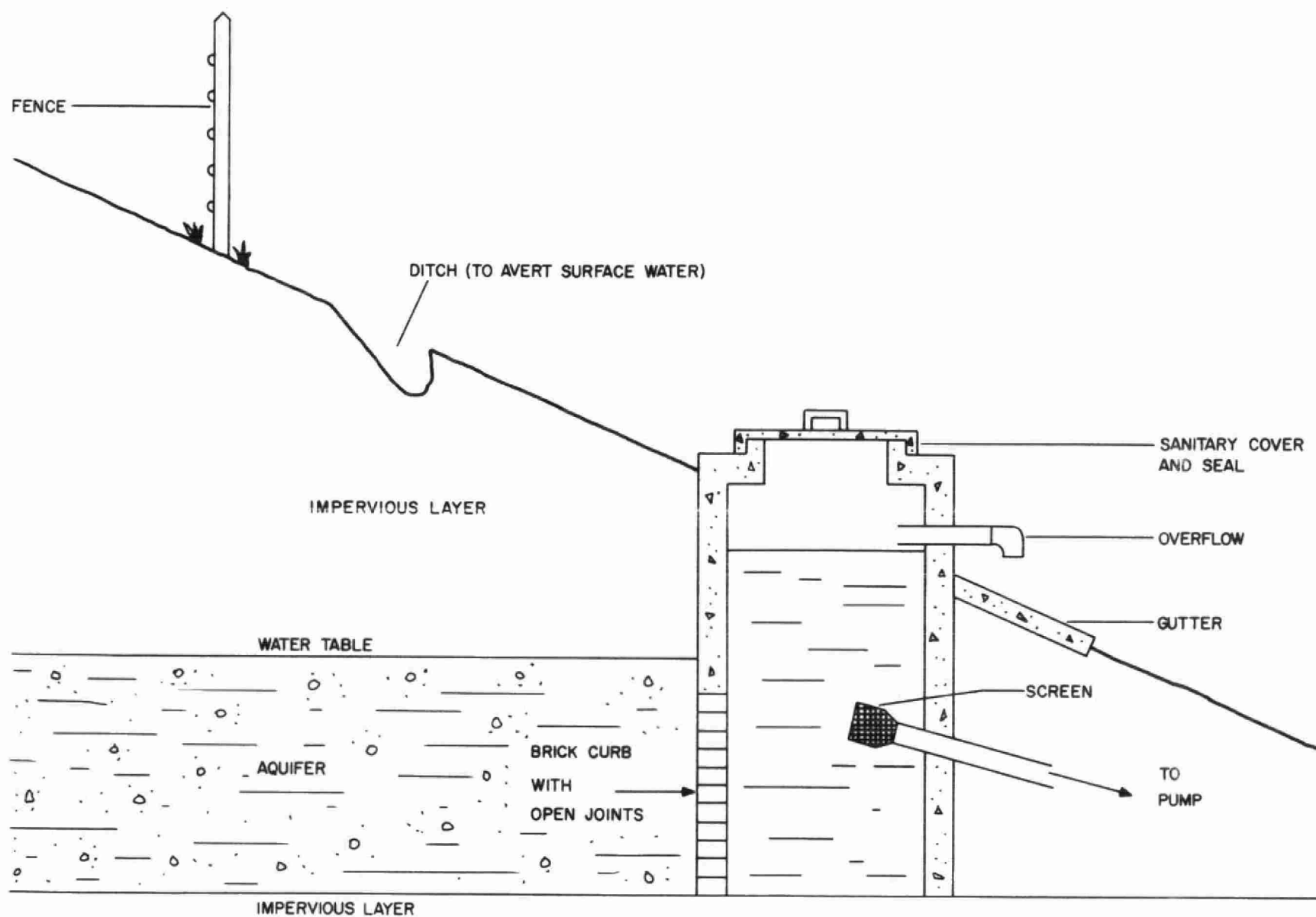
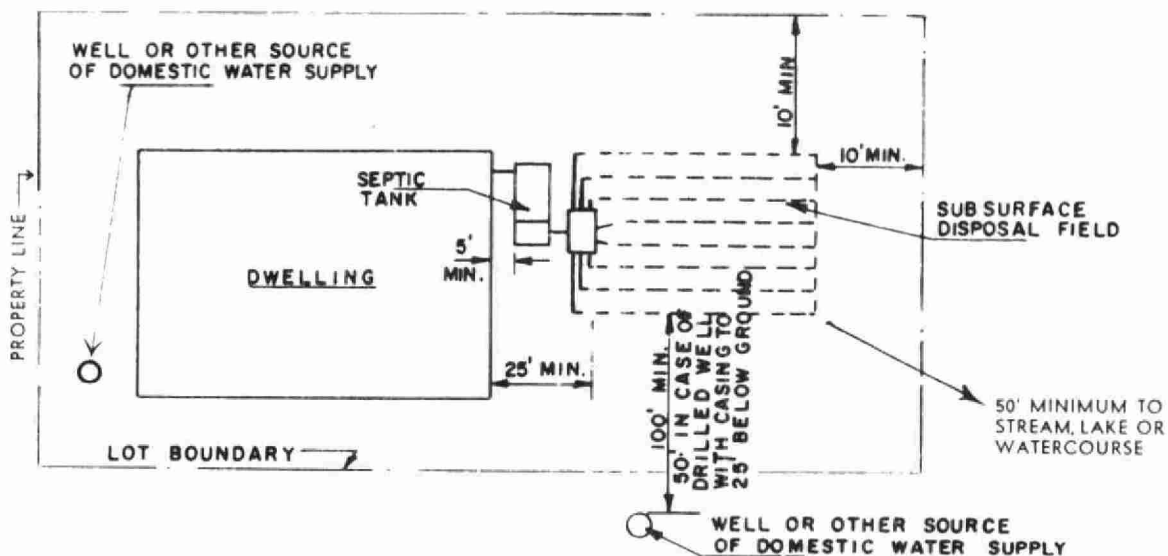
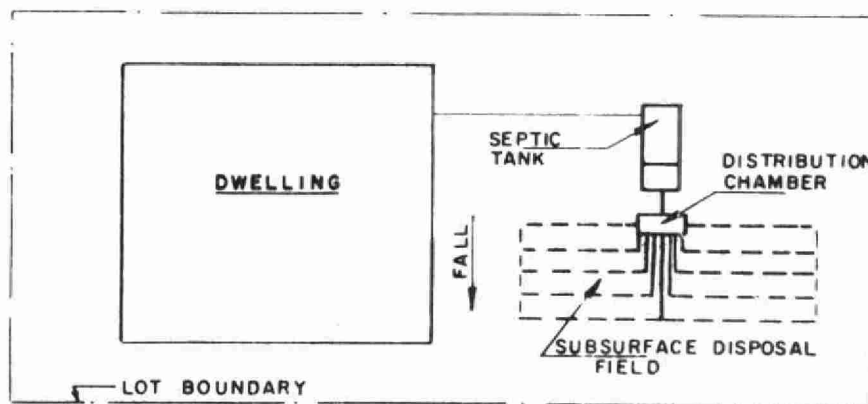


FIG. 5 - SUGGESTED CONSTRUCTION OF A SPRING SUPPLY



TYPICAL LAYOUT OF SEPTIC TANK AND TILE FIELD
(GROUND FAIRLY LEVEL)



ALTERNATE LAYOUT OF SEPTIC TANK AND TILE FIELD

NOTES:

1. The above layouts are suitable for well drained soil as determined by percolation tests. For other soils, alternative methods of disposal of the septic tank effluent may be necessary.
2. Location of tank and tile field to be on lower ground than adjacent wells, etc. if possible.
3. Internal plumbing and main drainage outlet should be designed with a view to connecting to possible future sanitary sewers.
4. Roof water, surface water, discharge from footing drains, etc. to be excluded from entry to septic tank.
5. Tile fields not to be located in swampy ground or in ground liable to flooding.
6. Inspect tanks annually. Clean the tank when combined depth of sludge and scum layers is $\frac{1}{3}$ the depth C (see drawing 2).
7. Method of sludge disposal to be approved by the M.O.H.

FIG. 6

SEPTIC TANK SYSTEMS
GENERAL LAYOUT
NOT TO SCALE
ONTARIO DEPARTMENT OF HEALTH ENVIRONMENTAL SANITATION BRANCH 1965

APPENDIX 23

TERMS AND SYMBOLS

	<u>PAGE</u>
EXPLANATION AND SIGNIFICANCE OF LABORATORY TERMS	293
ABBREVIATIONS AND SYMBOLS	299

DEFINITION OF TERMS

The laboratory analyses performed on samples submitted to either the Health Unit Laboratory in Palmerston or the Ontario Water Resources Commission Laboratory in Toronto included determinations of: biochemical oxygen demand (BOD), suspended solids, turbidity, pH, alkyl benzene sulfonate (ABS), phenols, hardness, alkalinity, chlorides, iron, colour, and several others where pertinent. These results were required in the chemical analyses performed whereas the bacteriological analyses required determinations of coliform organisms present in the water samples.

COLIFORMS

Coliform bacteria are commonly found in the intestinal tract of man and other warm-blooded animals and are therefore used as an indicator of pollution. In polluted water, their concentration is roughly proportional to the degree of sewage contamination present. The acceptable limit for natural watercourses, as set by the Department of Health, is a concentration of less than 2,400 organisms per 100 millilitres of water.

FAECAL COLIFORMS

The faecal coliforms are coliform bacteria usually associated

only with the faecal discharges of man and other warm-blooded animals and as such their presence indicates pollution from intestinal origin. When this coliform is present, it is assumed that the water is potentially dangerous when consumed.

BIOCHEMICAL OXYGEN DEMAND (BOD)

The biochemical oxygen demand, reported in ppm, is a measure of the amount of oxygen required for the natural stabilization of decomposable organic matter present in sewage. The completion of the laboratory test requires five days, under the controlled incubation temperature of 20°C. OWRC objectives allow concentrations in natural waters and waste discharges of no greater than 4.0 and 15.0 parts per million (ppm) respectively.

SOLIDS

The solids content of a liquid is expressed as total, suspended, and dissolved solids. The latter is determined by subtracting the first two solids and all three are expressed in ppm. The suspended solids figure is the most important since it represents that portion which is carried down current and later deposited. The OWRC's objective for the discharge of this material is a concentration less than 15 ppm.

Where suspended solids values approach 20 ppm or less, laboratory difficulties are experienced and, excepting the samples from sewage treatment works, the values of suspended matter are usually determined as turbidity.

TURBIDITY

Turbidity is caused by the presence of suspended matter, such as clay, silt, finely divided organic matter, plankton and other microscopic organisms in water. It is an expression of the optical property of a sample and results are reported in "Jackson Turbidity Units". The turbidity of treated drinking water should not exceed 1 Jackson Turbidity Unit.

HARDNESS

No specific limit is placed on hardness although it is usually recommended that waters for domestic use should contain less than 250 ppm hardness as CaCO_3 . This recommended limit has been used to avoid excessive soap consumption and other problems, primarily economic, usually associated with hard water. The degree of hardness is indicated as:

Soft	0 - 75 ppm
Moderately Hard	75 - 150 ppm
Hard	150 - 300 ppm
Very Hard	> 300 ppm

ALKALINITY

Alkalinity of natural waters is due to the presence of salts of weak acids, usually bicarbonates. The concentration is reported in ppm as CaCO_3 and is significant in determining aggressive tendencies and softening treatment requirements.

CHLORIDES

Chlorides are naturally present, in varying concentrations, in water supplies. Increasing chloride concentration may indicate contamination from domestic sewage.

The recommended maximum concentration to avoid slime tastes is 250 ppm as Cl.

IRON

The recommended maximum limit for iron in water supplies is 0.3 ppm. It is noted that waters with concentrations of iron in excess of 0.3 ppm are not harmful to consumers but have objectionable staining and sediment-forming properties, and may cause the deposition of iron in pipes or the growth of iron bacteria. If the concentration exceeds 1 ppm, problems with metallic taste may occur.

pH

The pH is an index of the acidity or alkalinity of the solution as represented by the instantaneous hydrogen ion concentration. The practical pH scale extends from 0, very acidic, to 14, very alkaline, with the middle value of pH 7 corresponding to exact neutrality (at 25°C). The objectives for surface water quality as adopted by the OWRC suggest that the pH of the waters following initial dilution, should not be less than 6.7 nor greater than 8.5.

COLOUR

The colour intensity of water is reported in Hazen units. The colouration of natural water may result from contact with organic matter or chemical substances. The recommended maximum colour content is 15 Hazen units.

ABS (Alkylbenzene Sulphonate)

The alkylbenzene sulphonate (ABS) is a surfactant extensively used in detergents and so is present in domestic sewage at levels averaging approximately 10 ppm. Rivers usually contain trace quantities of about 0.1 ppm, while ground water supplies range from zero to several parts per million depending upon the pollution of the aquifer by domestic wastes.

PHENOLS

The presence of phenol or phenolic equivalents is generally associated with discharges containing petroleum products or wastes from some industries. It is generally conceded that adequate protection of surface waters will be provided if the concentration of phenols in wastes is less than 20 parts per billion (ppb). Phenolic type wastes cause a great concern in chlorinated water supplies since the combination of chlorine with phenol forms a chlorophenolic compound which results in objectionable taste and odour problems. Phenols have also been known to taint the flesh of fish. The normal recommended maximum for phenolic concentrations in a drinking water supply is 1.0 ppb.

ABBREVIATIONS AND SYMBOLS

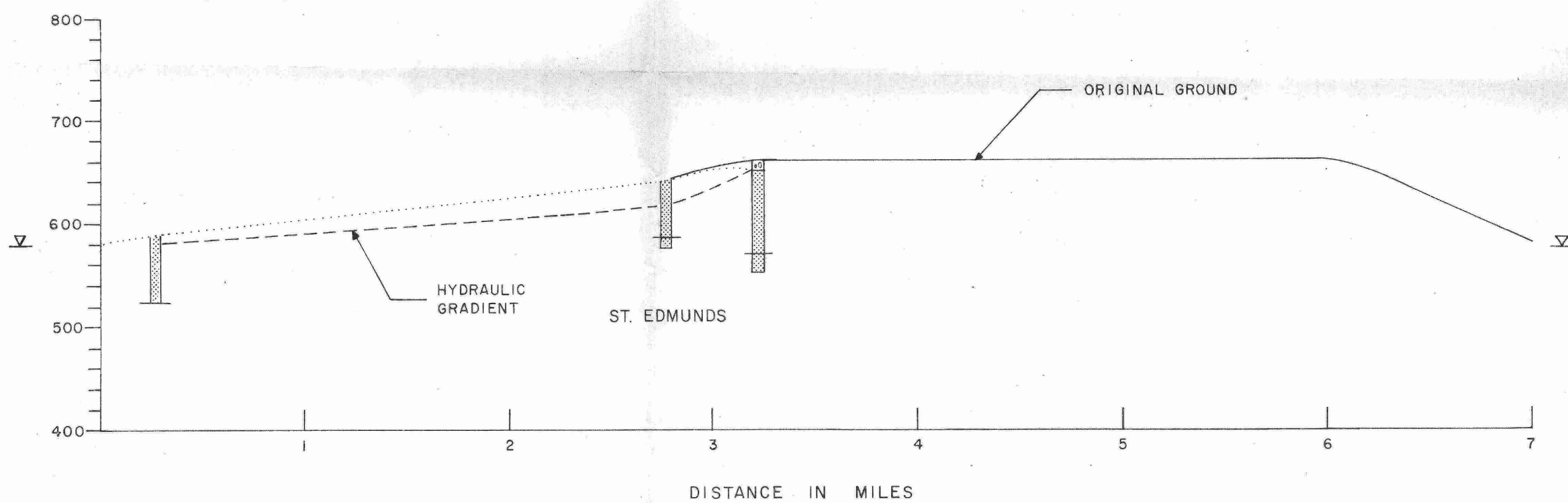
<u>TERM</u>		<u>EXPLANATION</u>
BOD	-	biochemical oxygen demand
gal.	-	gallons (Imperial gallons unless specified differently)
gpcd	-	gallons per capita day
gpd	-	gallons per day
gpm	-	gallons per minute
gph	-	gallons per hour
ppb	-	parts per billion
ppm	-	parts per million
ABS	-	alklybenzene sulphonate
mgd	-	million gallons per day
pH	-	hydrogen ion concentration
Twp.	-	township
STP	-	sewage treatment plant
WW	-	water works
OWRC	-	Ontario Water Resources Commission
>	-	greater than
susp.	-	suspended
diss.	-	dissolved
Fe	-	iron

<u>TERM</u>		<u>EXPLANATION</u>
CaCO ₃	-	calcium carbonate
Cl	-	chlorine
cfs	-	cubic feet per second

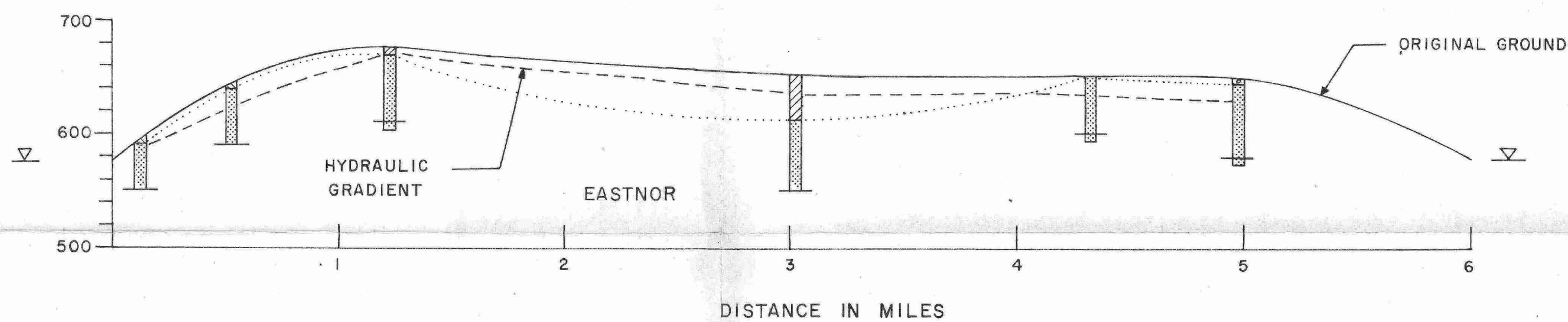
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5. Ontario Department of Health, Septic Tank Systems, 1965.
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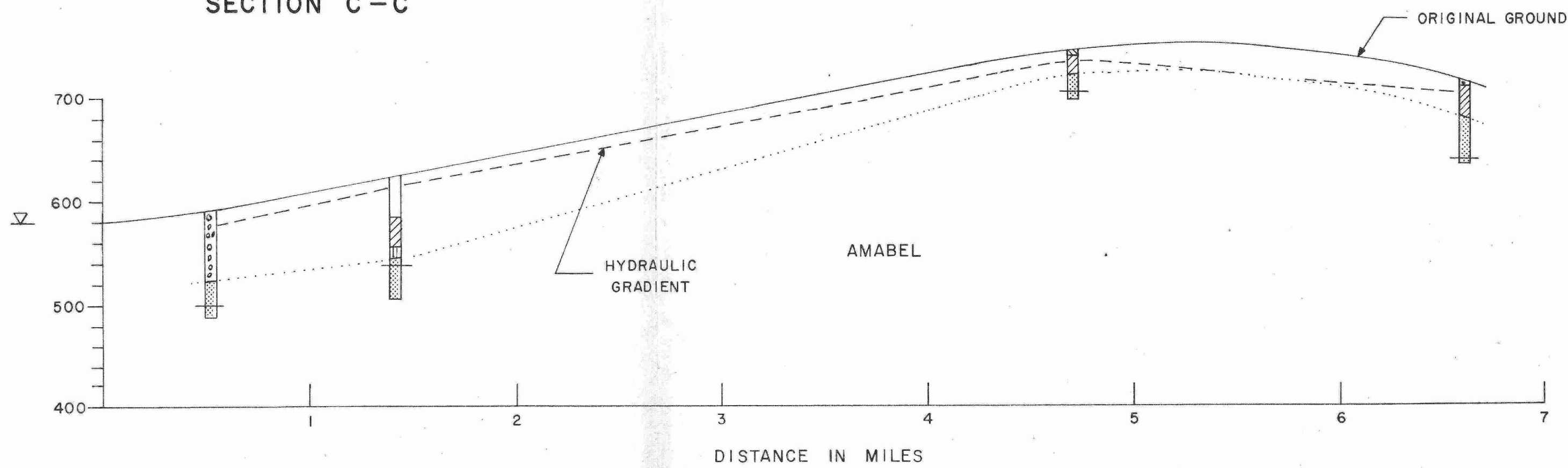
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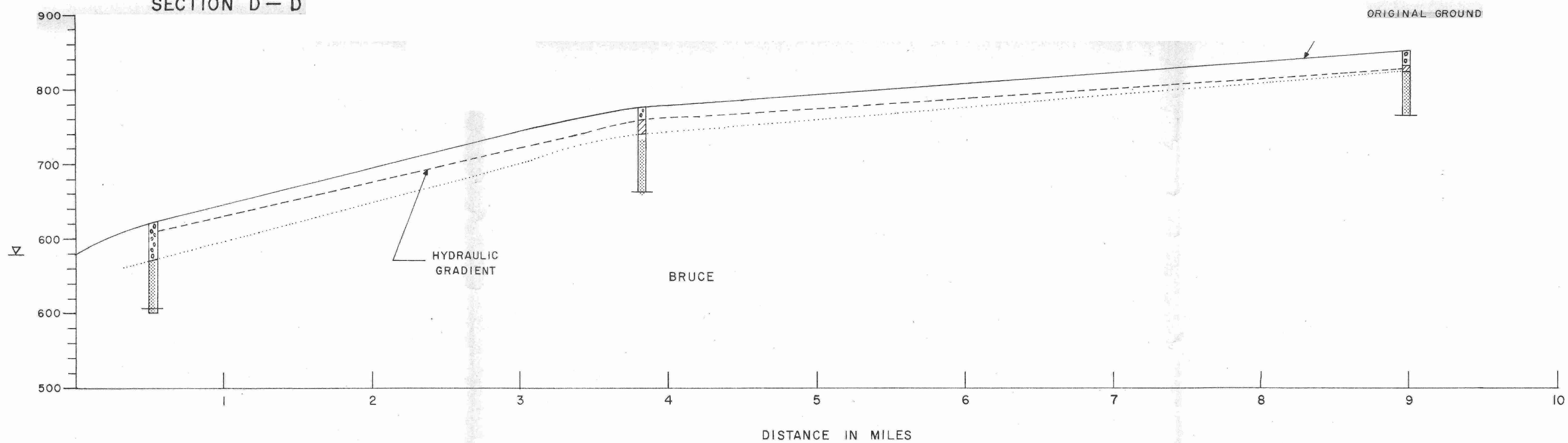
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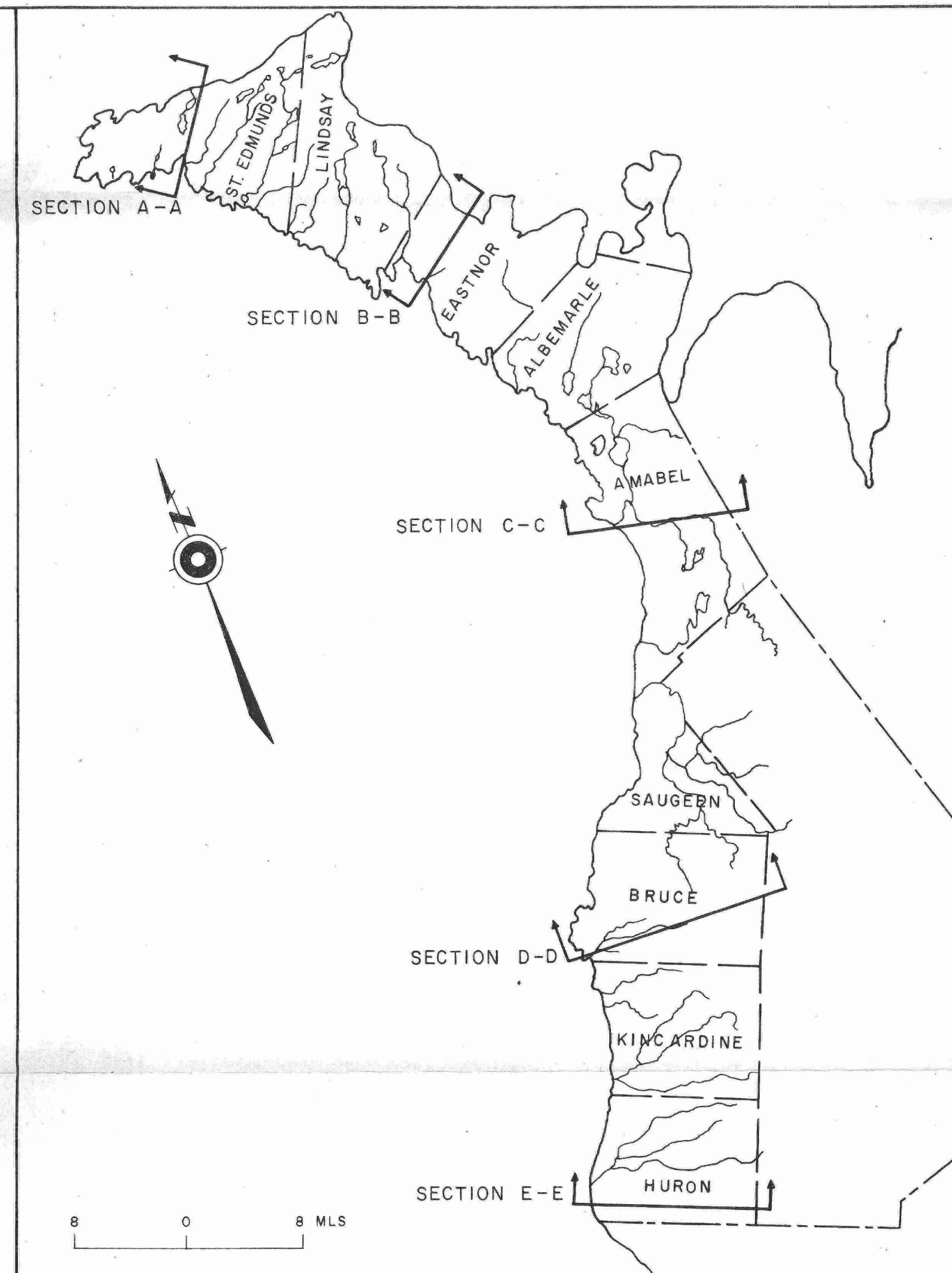
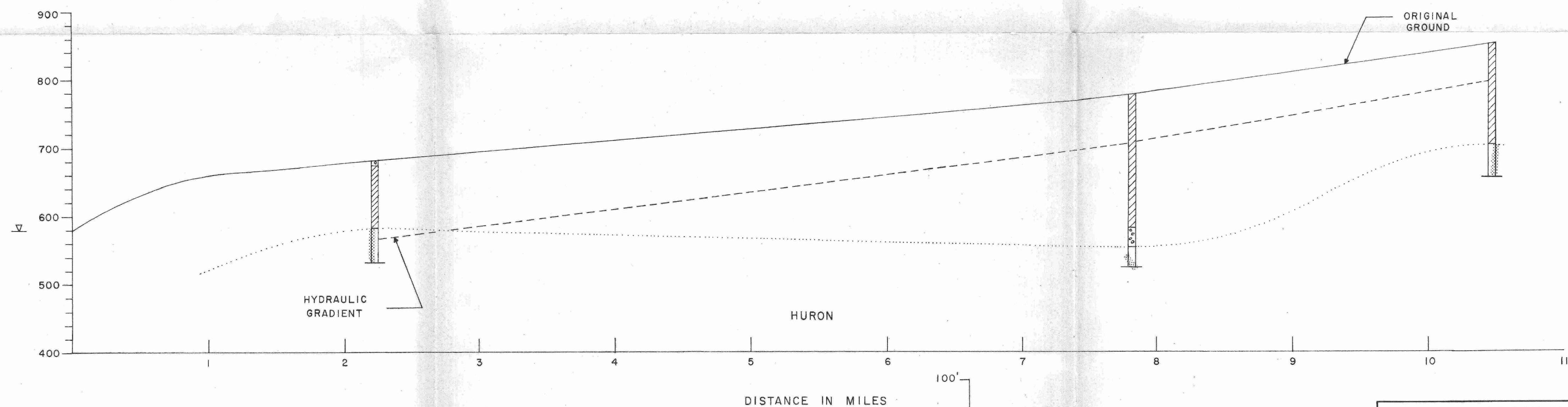
SECTION C - C



SECTION D - D



SECTION E - E



LEGEND

- BEDROCK SURFACE
- BEDROCK
- WATER LEVEL IN WELL
- LOOSE ROCK, BOULDERS, SAND AND GRAVEL
- CLAY HARDPAN AND MARL
- TOPSOIL
- QUICK SAND
- LAKE WATER LEVEL

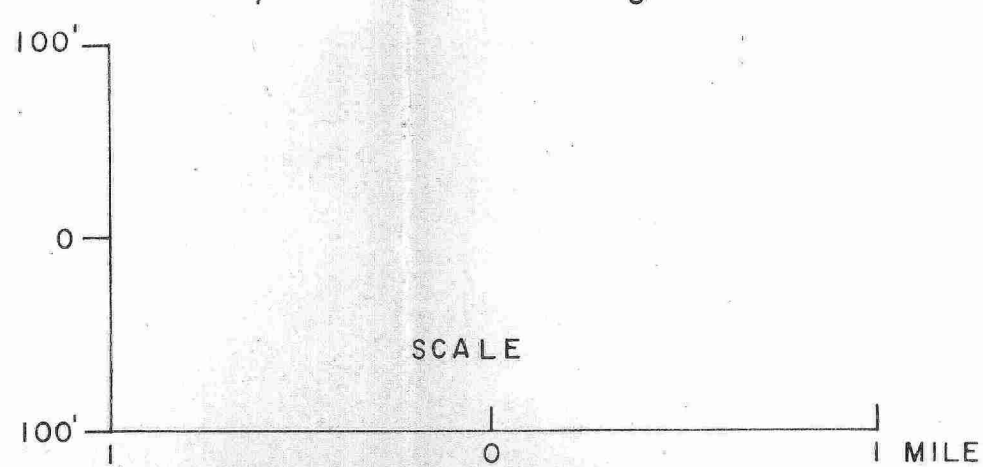
ONTARIO WATER RESOURCES COMMISSION

COUNTY OF BRUCE GEOLOGICAL CROSS SECTIONS FIG.-3

SCALE: AS NOTED
DRAWN BY: L.L. BROOME
CHECKED BY: E.S.

DATE: DECEMBER 1969
DRAWING No: 69-217-DE

SCALE



Date Due

MOE/BRU/REP/APKB +maps
Ontario Water Resources Co
Report on the
evaluation of ground ... apkb
Bruce County Shoreline C.T. a aa



(15995)

Q/183/O52/A45/1995/MOE